



Highways Department - Western Harbour Link Office

## Central Kowloon Route Study

Final Report

### Executive Summary



May 1993

Parsons Brinckerhoff Maunsell Consultants

in association with

MVA Asia · Shankland Cox · CES (Asia) · Chesterton Petty

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**Engineering Feasibility and Preliminary Design**

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### Engineering Feasibility and Preliminary Design

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## **1. INTRODUCTION**

**1.1** In accordance with the terms of Agreement No. CE 58/90, Parsons Brinckerhoff Maunsell Consultants was retained by the Highways Department-Western Harbour Link Office to perform the Central Kowloon Route Study.

## **1.2 STUDY BACKGROUND**

**1.2.1** The Second Comprehensive Transport Study (CTS-2), completed in 1989, proposed, amongst other proposals, improvements to Route 4 by 1996, to increase traffic capacity on East-West routes across Kowloon by the year 2001. However, the Central Kowloon Traffic Study (CKTS) and the West Kowloon Reclamation Transport Study (WKRTS) concluded later that additional East-West capacity would be required by 2001 even with the CTS-2 proposals in operation particularly since major developments were envisaged in Metroplan on both the West and East Kowloon.

**1.2.2** The WKRTS proposed a new dual two lane urban trunk route - the Central Kowloon route (CKR) as an alternative to upgrading existing routes with capacity limitations. This route was also referred to as the Cross Kowloon Route in various studies. As proposed, the route would have connected the West Kowloon Expressway (WKE) via an elevated route and tunnel through the centre of Kowloon to the planned North South Highway (NSH) off Bailey Street in To Kwa Wan. The primary function of the CKR would be to provide a trunk road across the centre of Kowloon and leave ground level roads to deal with the traffic within the broad metro districts.

**1.2.3** The CKR would have connections in the west with the WKE, the Reclamation Primary Distributor (Road P1) and the Western Harbour Crossing (WHC). The eastern end would have connections with the NSH, To Kwa Wan/Hung Hom and new routes serving Kowloon Bay Reclamation with a possible connection through to a long term route from Tseung Kwan O. (See Figure 1.)

## **1.3 STUDY OBJECTIVES**

**1.3.1** As stated in the Brief, the primary objectives of the study were :

- a) to further develop the alignment of the western approaches as determined by the WKE Consultancy and establish the cross-section of the elevated structure running parallel to Waterloo Road between the Yau Ma Tei Interchange and the tunnel portal off Nathan Road;

- b) to establish the best alignment and cross-section of the tunnel, in both bored and cut-and-cover sections, linking the eastern elevated structure with the interchange on the East Kowloon Reclamation;
- c) to establish the most suitable interchange arrangements between the CKR and the existing and planned road systems in East Kowloon;
- d) to prepare an acceptable layout and preliminary design for the selected structure and tunnel configuration and approach roads based on traffic forecasts for year 2011 including requirements relating to port and airport developments;
- e) to prepare schematic arrangements of tunnel mechanical and electrical systems based upon current international, Environmental Protection, Fire Services and Transport Department's standards for the most cost effective, safe and environmentally acceptable operation of the tunnels;
- f) to provide design information to transport projects in the vicinity such as the West Kowloon Corridor - YMT Section (Phase II) [WKC-YMT (II)] and the proposed Airport Railway which will cross the CKR within the elevated section.

1.3.2 During the course of the study, above objectives a), b) and f) evolved as follows:

- a) to further develop the alignment as determined by the WKE Consultancy;
- b) to establish the best alignment and cross-section of the tunnel, in both bored and cut-and-cover sections, linking the tunnel with the Yau Ma Tei Interchange and with the interchange on the East Kowloon Reclamation;
- f) to provide design information to transport projects in the vicinity such as WKC-YMT (II) which will cross the CKR within the tunnel section.

1.3.3 Further, during the second month of the study, it was noted that the Land Development Corporation (LDC) suggested the following additional objective:

- g) to derive a design which would both minimise the adverse effect on the LDC scheme area (south of Waterloo Road, between Ferry Street and Nathan Road), and allow the scheme to proceed in advance of the construction/commissioning of the new road.

## 1.4 STUDY OUTPUT

1.4.1 The Brief required preparation of a self-contained report and an executive summary. In addition, during the course of the Study, a series of working papers

and discussion papers on specific issues were prepared, circulated and discussed. The content of the papers and resultant discussions are incorporated into the Final report.

## **1.5 FORM OF FINAL REPORT**

### **1.5.1 The Final Report consists of four volumes**

Volume 1 - Preliminary Design

Volume 2 - Drawings

Volume 3 - Planning, Environmental and Urban Landscape assessment.

Volume 4 - Geological and Geotechnical Supplementary Information.

## **2. STUDY PHASES**

### **2.1 The study of the Central Kowloon Route ("CKR") proceeded through four basic study phases:**

Study Phase 1 : Assembly of base data and agreement on issues to be addressed.

Study Phase 2 : Preparation, assessment and discussion of options for various aspects of the project.

Study Phase 3 : Preparation of recommended scheme and preliminary design for the scheme.

Study Phase 4 : Circulation of Draft Final Report and preparation of Final Report.

### **2.2 STUDY PHASE 1**

#### **2.2.1 During this initial study phase, a number of constraints were identified in the western half of the originally conceived alignment which presented significant challenges :**

- a) CKR, as an elevated highway passing through the LDC site (south of Waterloo Road, between Ferry Street and Nathan Road), would limit LDC's flexibility for development. Further, the elevated highway would most likely need to be fully enclosed to avoid undue noise impacts. An enclosed,

elevated highway, of some 500 metres, would be both relatively expensive and visually intrusive;

- b) The originally conceived alignment would pass through the telephone exchange building at 524A Nathan Road. Early indications were reprovisioning of the facilities would be inordinately expensive (in excess of \$250 million) and time consuming (about three years); and
- c) The originally conceived alignment almost certainly would require resumption of a significant portion of the Lutheran School on Waterloo Road.

2.2.2 Thus, it was desirable to consider options to the western half of the originally conceived alignment earlier than initially contemplated. Therefore, late in Phase 1 of the Study, an assessment of options (a Study Phase 2 task) commenced, and the effort continued into Phase 2 of the Study.

## 2.3 STUDY PHASE 2

2.3.1 Traffic studies performed during Phase 2 of the Study confirmed additional East-West capacity would be required across Kowloon. The CKR would provide significant capacity relief to the Kowloon road network even prior to construction to the East Kowloon reclamation, while such additional capacity would be imperative after completion of the reclamation and its developments.

2.3.2 In this study phase, a significantly superior option to the originally conceived alignment, as per Appendix A of the Brief, was identified in Yau Ma Tei. This alignment, which is about 100 metres further south, would be in tunnel from the WKC eastward through Yau Ma Tei, avoids the LDC site, the telephone exchange and the Lutheran School. Further, after the highway is constructed the land above the tunnel can be redeveloped, with much less visual and landscape impact, than if the CKR was an elevated highway.

2.3.3 Field mapping indicated the geology of this part of Kowloon was more conducive to a tunnel the further south the alignment was located. Accordingly, the northward swing of the alignment in Ho Man Tin (as depicted in Appendix A of the Brief) was eliminated, and a straighter alignment from Yau Ma Tei to To Kwa Wan was adopted. This new alignment would be more economical to construct and it would in addition provide a much smoother ride for the driver.

2.3.4 During the last half of Phase 2 of the Study, an initial environment assessment was prepared, the various options were narrowed down and one scheme was recommended for preliminary design. Concepts for redevelopment above the highway tunnel were developed which indicated joint development would be feasible in certain locations.



2.3.5 During Phase 2 of the Study, route protection was addressed. The programme being developed for the CKR indicated a gap of possibly five or more years from completion of preliminary design to start of construction. As the potential CKR corridor is rather narrow and is constrained by numerous existing structures, there is limited flexibility to realign the CKR to avoid future development. The concern was expressed that private development might occur in the CKR corridor of such a nature that it might preclude construction of the CKR. Thus, protection from such a possible development was deemed essential.

## 2.4 STUDY PHASE 3

2.4.1 Several refinements/revisions to the selected scheme occurred during the preliminary design, including:

- a) The CKR box tunnel in Yau Ma Tei was narrowed to minimum dimensions to avoid the need to resume three existing schools on the north side of Tung Kun Street between Ferry Street and Reclamation Street.
- b) The decision to toll the CKR from its opening was confirmed.
- c) A method for exhausting tunnel emissions, using ventilation stacks at the portals, was developed. This new method was necessary because of recent worldwide findings by the Permanent International Association of Road Congresses ("PIARC") which had issued a report revising upwards the estimated amount of future air emissions from vehicles.

## 2.5 STUDY PHASE 4

2.5.1 During this study phase, the entrusted works in the West Kowloon Corridor (WKC) were prepared. The entrusted works consist of the top slab and diaphragm walls of the CKR box tunnel under the various streets and highways to be constructed in the WKC project.

2.5.2 The results of the comments and responses to the Draft Final Report were incorporated in the Final Report. For a listing of the comments and responses, refer to Volume 1, Appendix B of the Final Report.

## 3. ALIGNMENT AND PHYSICAL FEATURES

3.1 Figure 2 depicts the recommended CKR alignment connecting the Yau Ma Tei interchange in the west with the interchange on the East Kowloon Reclamation.

The CKR will be a dual two-lane trunk road and will be in tunnel from Ferry Street (in Yau Ma Tei) to Yuk Yat Street (in To Kwa Wan).

- 3.2 The major auxiliary structures will be the administration building, workshop and a ventilation building in the eastern interchange, a ventilation building near the mid-point of the CKR where it will pass beneath Fat Kwong Street, and a ventilation building, probably integrated with a proposed car park, on the West Kowloon Reclamation.

#### 4. IMPLEMENTATION PHASES

##### 4.1 THREE CONSTRUCTION PHASES

- 4.1.1 The first phase (referred to as "Phase 1" would provide for the CKR connecting the Yau Ma Tei Interchange with the local street network in To Kwa Wan. It would be constructed prior to construction of the Kowloon Bay Reclamation, the North-South Highway (NSH) and the eastbound extension of the CKR across the Kowloon Bay Reclamation (referred to as the "Kowloon Bay Connector" or "KBC").

- 4.1.2 The second phase (Phase 2) would provide for the interchange between CKR and NSH and would require construction of a short portion of the Kowloon Bay Reclamation.

- 4.1.3 The final phase (Phase 3) would provide for the interchange of the KBC with the CKR-NSH Interchange after construction of the Kowloon Bay Reclamation.

##### 4.2 ADVANCED WORKS

- 4.2.1 To facilitate construction of the CKR and avoid undue disruption to other facilities, works for the CKR should be incorporated in the following projects which are all due for construction in advance of the CKR construction:

- 4.2.1.1 WKC: Works consisting of diaphragm walls and the top slab of the CKR sufficient to enable Phase 1 of the CKR to proceed with minimum disruption to traffic on roadways constructed under the WKC programme.

- 4.2.1.2 Car park: If the car park at Road D1 on the West Kowloon Reclamation is constructed prior to the CKR, then works should be incorporated in the building to provide a fan room and a ventilation shaft.

- 4.2.1.3 USD "G" Site: Assuming a sports complex at the USD "G" Site on Ko Shan Road will be constructed prior to the CKR, sufficient space for the CKR to pass beneath the building or through the basement will be required. Walls, slabs and possibly increased sizes of foundations would constitute the works. Also space for two truck lifts in the building would be provided. Truck lifts would only be added into the building and utilized if time was not available to haul all rock excavation eastward through the eastern cut-and-cover tunnel.
- 4.2.2 Other advance works may be necessary if development of other sites along the route are proposed. There is a need to keep in view possible development along the route.

## **5. PROGRAMME**

- 5.1 The Final Report was prepared based on the assumption that Phase 1 of the CKR will open to traffic in January 2001. No specific opening date is recommended at this time until the results of the South East Kowloon Development Statement (SEKDS) are available.
- 5.2 A minimum of 94 months (seven years, ten months) should be allowed to implement CKR Phase 1 through gazetting, detailed design, contract award and construction. As tunnel construction may encounter unforeseen conditions and other events may occur over the almost eight year duration, it is recommended that an additional year be allocated as a contingency. Thus, it is further recommended that selection of consultants commence eight years and ten months prior to the planned Phase 1 opening.

## **6. FINANCIAL MATTERS**

### **6.1 TOLLING**

- 6.1.1 The results of the Study confirmed that tolling the CKR would result in fewer vehicles using the facility. However, because toll revenues represent an effective method for financing the CKR, a policy decision was given that CKR would be tolled from its initial opening.
- 6.1.2 The Study did not include a recommendation of toll level for which a detailed traffic impact study of Kowloon would be required to ascertain the effect on the complex road network in Kowloon for different toll levels.

## **6.2 PRIVATISATION**

- 6.2.1 Privatisation, where a developer will finance the detailed design, construction and operation of the CKR, represents a potential alternative approach to implement the facility.
- 6.2.2 The developer would recover its costs from toll revenues and, optionally, from land development above the CKR.
- 6.2.3 A financial study to assess privatisation options including development rights should be undertaken if private financing is to be considered further. Early completion of the study would provide additional flexibility to Government in its deliberations.

## **7. REDEVELOPMENT OPPORTUNITIES**

- 7.1 The decision to construct the CKR in a tunnel largely removes the blighting effect of the route. In fact, the resumptions and limited demolition required to construct the cut-and-cover tunnel could actually facilitate urban restructuring providing rebuilding takes place to an appropriate plan.
- 7.2 Beyond the immediate vicinity of the western and eastern approaches development area, the tunnel runs deep and will be constructed using traditional rock boring techniques of drilling and blasting. Throughout these portions of its length, while there are not any development opportunities, there will be little or no disturbance to existing buildings or land uses.

## **8. ROUTE PROTECTION**

- 8.1 The proposed alignment will traverse built-up areas and will require the demolition and clearance of several private lots to facilitate construction. At present, many of the buildings along the route are medium to low rise old structures which, if acquired now, could be redeveloped in conjunction with the construction of the tunnel. However, the road is not scheduled for construction to commence until 1997 and, in the interim, there is no way of preventing the redevelopment of these private lots. If such redevelopment is carried out, the redeveloped properties would encroach upon the corridor imposing constraints upon subsequent acquisition, clearance and tunnel construction.

- 8.2 The Study has identified the properties which would be affected along the proposed alignment, and land searches reveal that there is a high probability of redevelopment taking place prior to 1997 particularly in the area of the Western Approaches, where the majority of the properties to the west of Nathan Road are in single ownership. (Multiple ownership is generally considered to be one of the main obstacles to redevelopment taking place, whereas buildings in single ownership are quite likely to be redeveloped when economic conditions are appropriate.)
- 8.3 Effect of Redevelopment : At present, many of the single ownership buildings are medium to low rise structures. Upon amalgamation of sites, redevelopment can be expected to be more intensive and, if the route is not protected at an early stage, Government would be faced with the resumption of a recently constructed building.
- 8.4 The need to protect the alignment of the route was examined in the Study and has subsequently been the subject of extensive consideration within Government. It has emerged that there is at present no established mechanism by which the route can be protected while at the same time blighting of properties along the alignment of the road is avoided. There are currently no statutory measures available for route protection prior to the authorisation of a scheme under the Roads (Works, Use and Compensation) Ordinance.
- 8.5 It is recommended that the principle of route protection be considered as a territory-wide matter. If action is not taken at an early stage, there may be a need for the acquisition of a greater number of substantial buildings than is currently anticipated.
- 8.6 It is recommended the CKR preliminary design corridor be established in detail to assist in defining the area requiring route protection.

## **9. ENVIRONMENTAL AND URBAN LANDSCAPE ASSESSMENT**

### **9.1 NOISE**

- 9.1.1 The decision to route the CKR in tunnel for most of its length provides, by far, the most effective mitigation solution for reduction of noise impacts to existing receivers.

- 9.1.2 The noise contribution from the CKR to the higher floors of certain residential zoned areas on the West Kowloon Reclamation (WKR) is potentially in exceedance of criteria. Before commencing detail design, a review of planned, or then existing, sensitive uses on the WKR should be undertaken to ascertain if noise mitigation will be appropriate. Development of these sites prior to the construction of the CKR should take into account the effects of the CKR.

## **9.2 AIR QUALITY**

- 9.2.1 None of the identified permanent and non-permanent Air Sensitive Receptors in the existing land at west and east portals and mid-vent building are estimated to exceed the limit of Air Quality Objectives (AQOs).
- 9.2.2 The operational air quality impact at west portal reclamation area is estimated within the acceptable levels of AQOs.
- 9.2.3 The area enclosed by Yuk Yat Street, Hoi Sham Park and CKR approach roads at east portal reclamation is estimated to exceed to the limit of 1-hour NO<sub>2</sub> exposure limit. The future development planning at east portal should take into account the air quality requirement.
- 9.2.4 Prior to commencing detail design, a review of the then existing and planned sensitive receptors should be undertaken. If necessary, the three vent stacks (west portal, Fat Kwong Street, and east portal) could be adjusted or raised to improve the estimated air quality at the sensitive receptors.

## **9.3 WATER QUALITY**

- 9.3.1 A possible tunnel spoil disposal option would be to use the material to form a small reclamation in Kowloon Bay. The reclamation would be approximately three hectares in area, and this disposal option would have considerable cost advantages. As this option is still only conceptual, it is not appropriate to undertake a full water quality assessment at this stage, however, if it is decided to pursue this option, the water quality impacts should be reviewed.

## **9.4 URBAN LANDSCAPE**

- 9.4.1 During the construction of the works there would be a significant visual impact on the residents and users of the neighbouring buildings and streets from the loss of building, the excavation and engineering works and the reconstruction of the buildings. However this impact would be limited to the construction period and

there would not be any significant long term impact once construction is completed and the building lots affected are redeveloped.

9.4.2 The Ko Shan Park space will be reconstructed in its present form with footpaths, seating areas and planting beds, with the use of some semi-mature trees to increase the immediate impact of the replacement planting, to compensate for those that would be lost. There will be no longer term visual impact in the park area.

9.4.3 On completion of the project the east portal and the toll plaza will be visible from the existing buildings to the north and west, although with the portal and plaza at well below ground they will be viewed against a backdrop of the reclamation development. Dense tree and shrub planting is proposed for the areas adjacent to the new roads and in the embankments for roads leading to and from the tunnel. These will screen the views near ground level from the reclamation, break up the extent of the hard paved road space and also provide a suitable setting for the road.

## 10. COST

10.1 Cost estimates were prepared for land resumption, construction, tunnel operation and maintenance. All costs are at August 1992 prices and exclude allowances for price escalation, design fees and site supervision during construction.

10.2 The estimated cost of land resumption is \$4420 million based on current land values and policies and practices adopted by Government in payment of compensation to properly owners and tenants.

10.3 The total construction cost for the Central Kowloon Route is estimated to be \$2416m at August 1992 prices and including an allowance of 28% for Project Contingencies and Contract preliminaries and contingencies. A breakdown of the construction cost estimate is given in Table 10.1.

10.4 Annual tunnel operation and maintenance costs are estimated to be :

Staff and equipment replacement	\$24m
Electricity cost	\$15m
TOTAL	\$39m

**Table 10.1 Estimated Construction Cost**

Item	Cost (\$m)
1. Advanced Works	
1.1 WKC Entrusted Works	36
1.2 Carpark Entrusted Works	11
1.3 USD 'G' Site Entrusted Works	31
Advanced Work	TOTAL : 78
2. Tunnel Construction Phase 1	
2.1 Western Approach	95
2.2 Tunnels	1241
2.3 Ventilation Buildings	43
2.4 Eastern Approaches	73
2.5 Toll Plaza and Administration Buildings	21
2.6 E&M System	444
2.7 Miscellaneous	34
Phase 1	TOTAL : 1951
3. Construction Phase 2	278
4. Construction Phase 3	109
TOTAL Construction Cost	2416

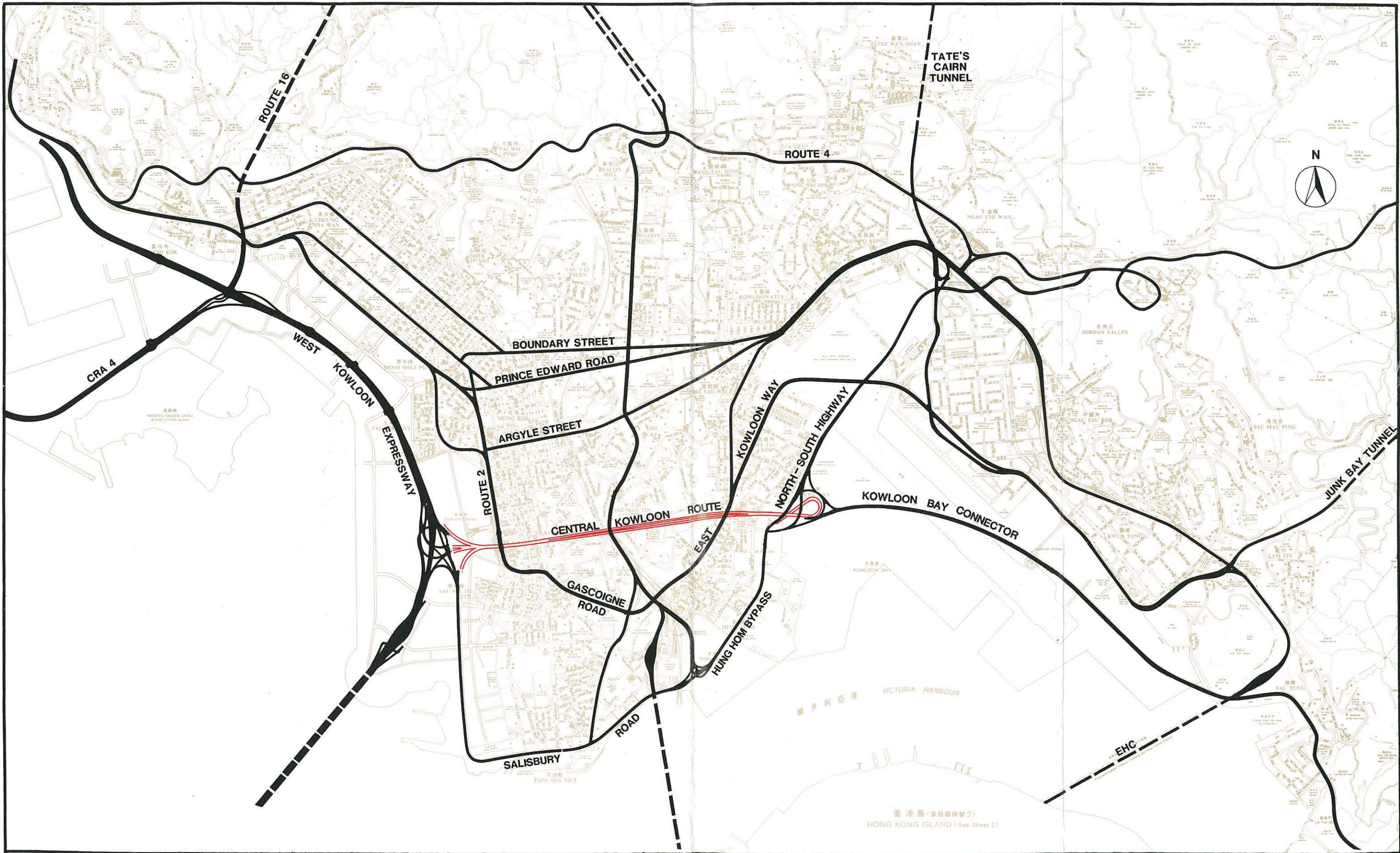
## 11. ON GOING ISSUES

The completion of this study marks the end of this stage of the project's development, however there is a need for continuing input into matters which extend beyond the study.

- The detailed design has been undertaken for a section of the cut and sever tunnel beneath Ferry Street. This will be constructed under the WKC-YMT(II) contract and there is a need for design backup services during the construction.



- If the results of this study are not to be wasted then the alignment must be protected to prevent building and other development which could prejudice the roads construction. The means by which this route protection can be effected needs to be pursued within Government, and to enable the protection to be effected the limits for the area to be protected must be fully defined.
- Advice on an on-going basis will be required to Government Departments and others to ensure that works proposed within the protected area are not incompatible with the CKR.



Parsons Brinckerhoff  
Maunsell Consultants

**Central Kowloon Route Study: Executive Summary**  
**Kowloon Road Network**

FIGURE NO

**1**

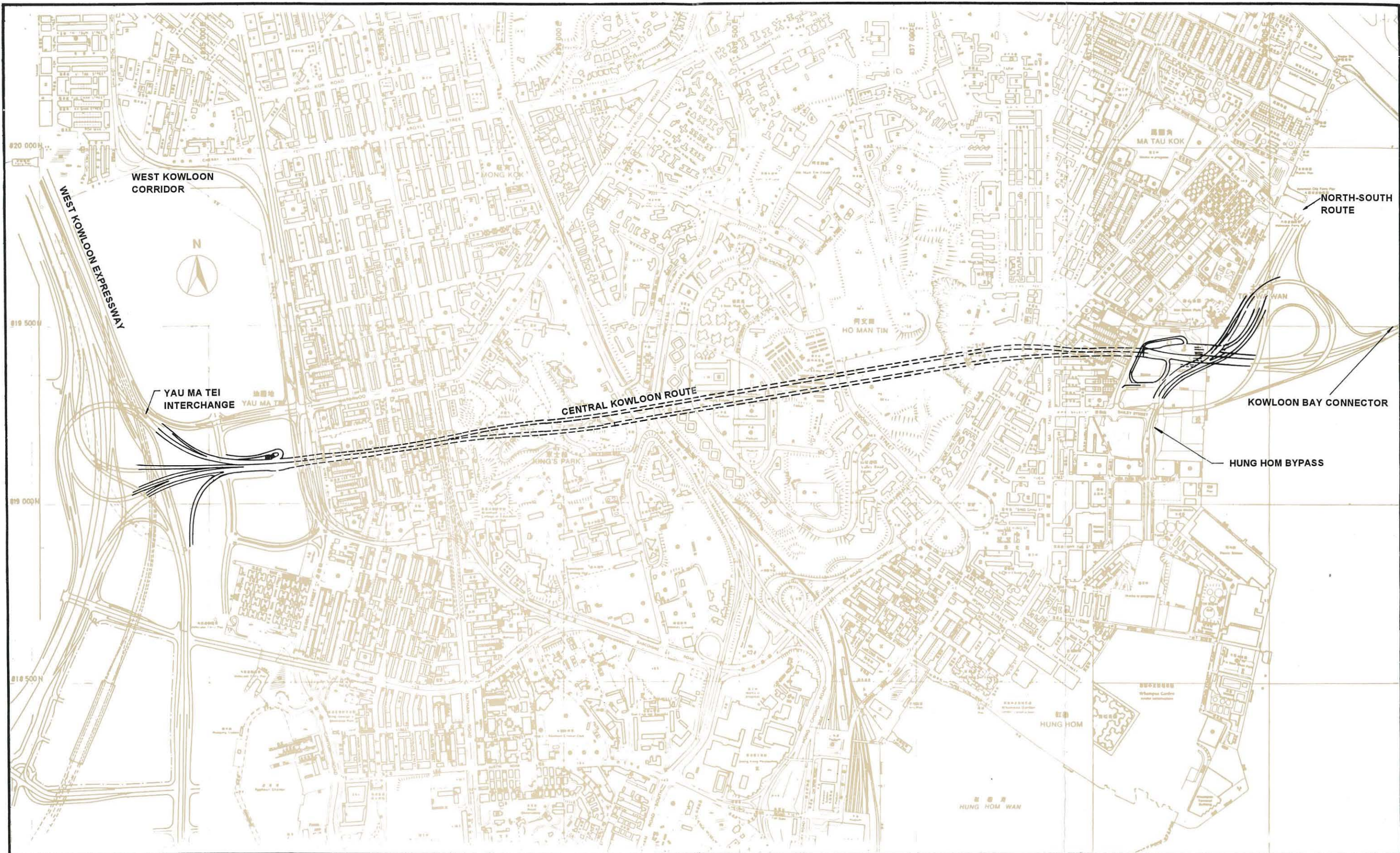
SCALE

0 300 600m



DATE

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**Central Kowloon Route Study: Executive Summary**  
**Route Alignment**

FIGURE NO

**2**

SCALE

0 50 100 200m

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April 1993

