

JPanCafferty

TUEN MUN ROAD STAGE 1

屯門公路第一期



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CLIENT AUTHORITIES: Highways Office and
Tuen Mun New Town Development Office
Public Works Department
Hong Kong

ENGINEER : Scott Wilson Kirkpatrick & Partners
Consulting Engineers
Hong Kong

CONTRACTORS : Kumagai Gumi (Hong Kong) Ltd
— Main and Sham Tseng Viaduct Contracts
Hsin Chong Construction Co. Ltd
— Link Road Contract

PROJECT DATA

Main Contract Tender Sum	\$222,246,768
Sham Tseng Viaduct Contract Tender Sum	\$ 17,559,024
Link Road Contract Tender Sum	\$ 23,730,702
Length of Road	17.0 km
Earthworks Excavation	5,700,000m ³
Fill	4,500,000m ³
Pipe and Box Culverts — length	5.0 km
Underpasses	12 No.
Prestressed — Beam Road Bridges	9 No. (1.5 km)
In-situ Road Bridge	1 No. (0.1 km)
Footbridges	3 No.

Prepared by SWK for PWD

屯門公路第一期

負責發展之政府部門：香港工務司署之路政處及屯門新市鎮
拓展工程處

工程師：史葛惠柳新高柏力組合顧問工程師

承建商：熊谷組（香港）有限公司
——主要合約及深井高架橋道合約
新昌營造廠有限公司
——連接路合約

工程資料數字

主要合約投標款額	222,246,768元
深井高架橋道合約投標款額	17,559,024元
連接路合約投標款額	23,730,702元
道路長度	17.0千米
開掘之土方工程	5,700,000立方米
填土	4,500,000立方米
排水管及盒形暗渠——長度	5.0千米
行車隧道	12處
預應力樑所建之公路橋	9座（1.5千米）
原地建成公路橋	1座（0.1千米）
行人橋	3座

Front Cover : Ch. 2000 — 4000 near Ting Kau
封面 近汀九的一段屯門公路

Back Cover : Ch. 3700 — 4200 incl. Telford Bridge
封底 泰福橋的一段屯門公路

INTRODUCTION

Tuen Mun is one of the three New Towns being developed in the New Territories. It is 17 km west of Tsuen Wan and 32 km by existing roads from Star Ferry, Kowloon. By 1986 the New Town will have nearly half-a-million people.

From the early planning stages of the New Town, it was clear that the existing tortuous Castle Peak Road would prove an inadequate link between Tsuen Wan and Tuen Mun. A high-capacity road link was considered an essential pre-requisite to the development of Tuen Mun.

The Hong Kong Government commissioned Scott Wilson Kirkpatrick and Partners to prepare a report on a new road between the two towns and, following its acceptance, to design and supervise construction. Tuen Mun Road, as it is now called, is Hong Kong's first high-capacity limited-access rural highway. It is being constructed in two stages.

Construction of the first stage commenced in October 1974 and involved the completion of the first carriageway of what will eventually be a dual three-lane road some 17 km long. Also included was the formation works for the second carriageway over about 7.3 km of its length and the complete construction of the two intermediate interchanges. The first carriageway is marked as two lanes uphill and one lane downhill for most of the length of the road.

Construction of the second stage will commence soon after the first carriageway is opened to traffic. When completed, Tuen Mun Road will form part of Route 2 which will provide continuous dual-carriageway travel from Tuen Mun to Kowloon.

緒言

新界現正發展三個新市鎮，屯門即其中之一。該新市鎮位於荃灣以西17千米，以目前路程計算，距離九龍天星碼頭為32千米，預料到一九八六年該地將有居民達到五十萬名。

當局於策劃發展新市鎮之初，即發覺蜿蜒曲折之青山公路，將不足以成為聯繫荃灣與屯門之主要道路，故建築一條可容大量交通順利來往之新路以連接該兩市鎮，實為發展屯門所必需之先決條件。

有關建築此新路以連接該兩市鎮問題，政府曾委託史葛惠柳新高柏力組合擬訂報告書，並於接納其建議後，委任該公司策劃及監督該項工程。該新路現已命名為「屯門公路」，乃本港第一條可容大量交通而支路又少之郊區高速公路。

屯門公路之首期工程於一九七四年十月動工，包括將第一條行車路建成，該路將為長達17千米之雙程三線行車路之一部份，此外並包括長約7.3千米之第二條行車路開拓工程及兩個中途交匯處之全部建築工程。大致上，第一條行車路暫時會有兩線劃給上斜之用，其餘一線則作落斜使用。

第一條行車路通車後，該公路之第二期工程即將動工，完成後，整條屯門公路將成為第二號公路之一部份，該第二號公路乃由屯門直達九龍之雙程行車路。

ROUTE

At its eastern end, Tuen Mun Road connects with Castle Peak Road at a traffic-signal controlled junction. When the Tsuen Wan By-pass is constructed, this connection will become one of the slip roads in a three-level interchange.

The road climbs to a high point near Ting Kau giving a panoramic view of the Harbour and islands. The natural slope of the ground in this area is very steep, so the road is carried on a viaduct constructed just below the existing catchwater. The road crosses two deep valleys before it descends to Sham Tseng.

Sham Tseng is a large village separated from the sea by Castle Peak Road with a bakery, chemical works, brewery and textile factory built on the waterfront. An interchange with Castle Peak Road serves the traffic needs of this developing village. Tuen Mun Road passes the village on a high-level viaduct before climbing for another 2 km through sparsely populated countryside.

Because of the massive rock formation at Brothers Point, at the eastern side of Tai Lam Bay, the new road has been constructed close to the shore line with the existing Castle Peak Road being re-aligned on reclamation. Tuen Mun Road descends rapidly to this shore line before crossing the bay on a causeway with a bridge built to allow for the discharge from Tai Lam Chung Reservoir. The enclosed area of the bay is expected to be reclaimed eventually. A second intermediate interchange is located at the western side of the bay and provides access to nearby villages and the Lok On Pai desalter.

The chosen route cuts inland and follows a succession of ridges and cultivated valleys for the next 3 km. The road then runs through broken land separating Army barracks from their training grounds to the north. At its western end, Tuen Mun Road connects directly into the centre of Tuen Mun over a reclaimed section of the Castle Peak Bay.

屯門公路之路線

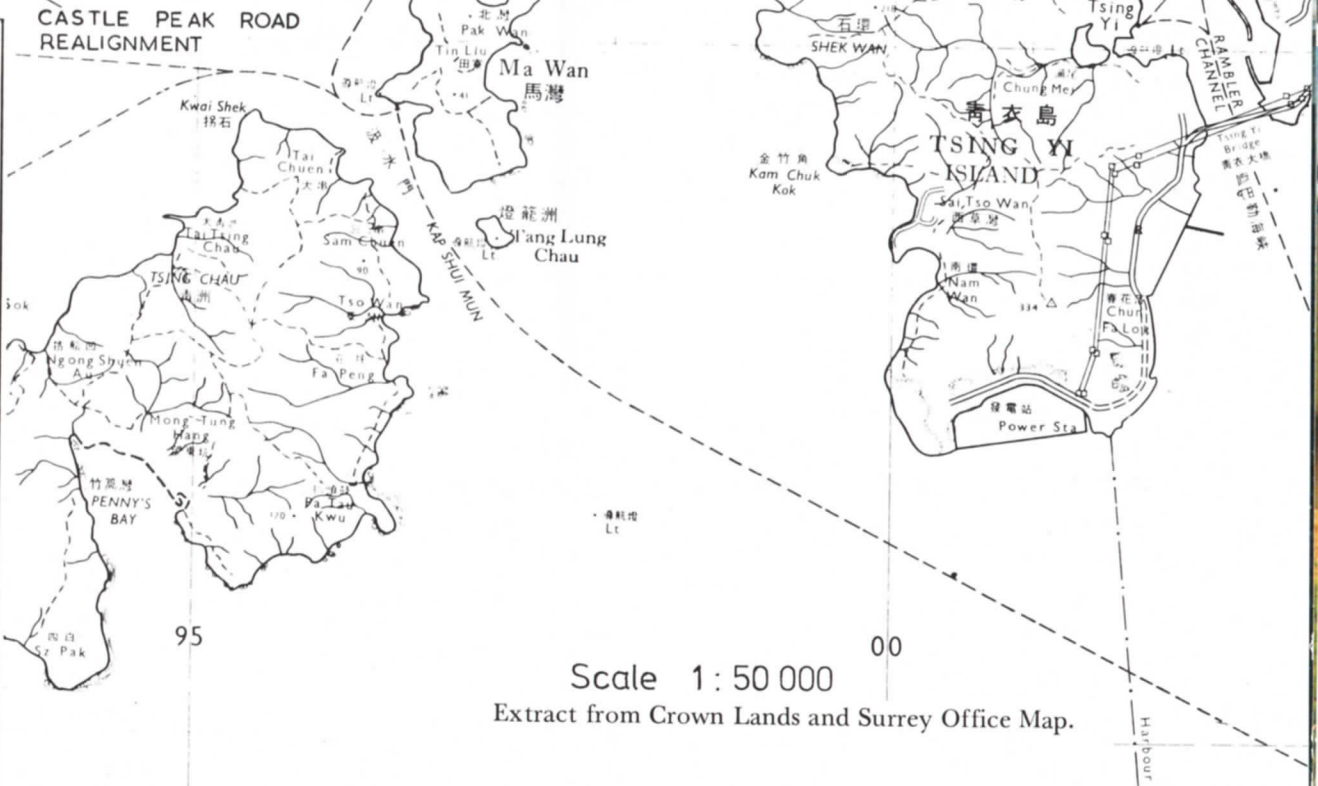
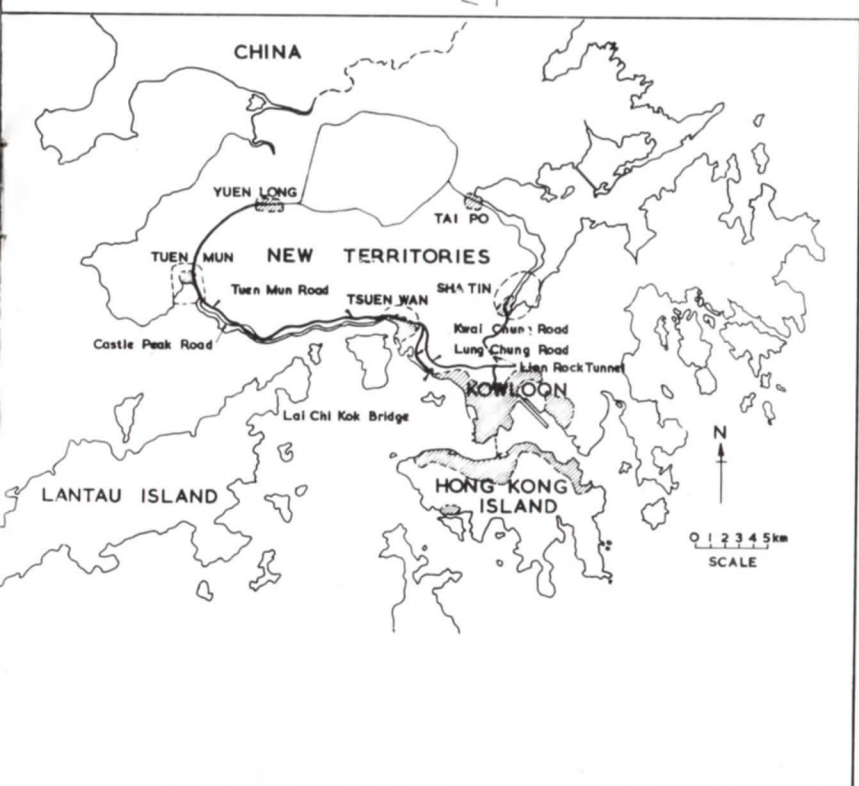
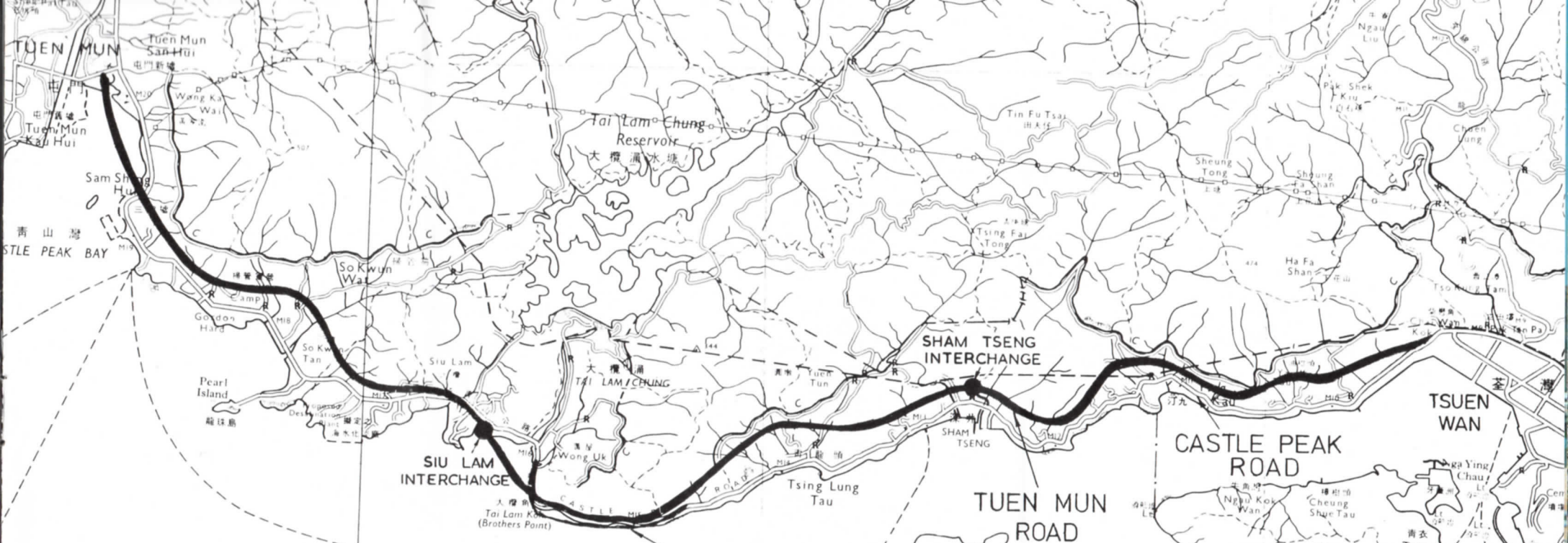
屯門公路向東之一端與青山公路相接，其匯合處將設有交通燈號。待荃灣旁道建成後，該處將成爲一個三層交匯處之其中一條連接路。

屯門公路在汀九附近爬至很高，足以俯瞰整個海港及各島嶼之全景。該區地勢陡峭，故屯門公路必須建於引水道稍下之高架橋上，橫越兩個深谷之後，始徐徐向深井而下。

深井乃一大村落，與海濱相隔着一條青山公路，海傍建有麵包廠、化工廠、釀酒廠及紡織廠。該村正在日益發展，且交通繁忙，因此建有交匯處，與青山公路相銜接。屯門公路行經此村時，須在一架空之橋樑上通過，然後再向上爬昇2千米，沿途盡是人烟稀少之郊區。

鑑於大欖灣以東之大欖角有巨大石藏，屯門公路須沿岸建築，而現有之青山公路則改行在新填之堤壩上。屯門公路向下急降至該海岸後，再沿一條堤道橫過大欖灣。該堤道設有橋樑，以便大欖涌水塘溢出之存水出海。大欖灣內由該堤道所圍封之部份，日後將以泥土填平，其西面設有第二座中途交匯處，以便車輛通往附近之村落及樂安排海水化淡廠。

屯門公路隨後向內陸前進，在長約3千米的車路，經過一連串山脊及有耕作之山谷後，該公路便在崎嶇不平之山地上奔走，並將目前之軍營及其北面訓練場地分隔爲二。到達其西端時，屯門公路將通過青山灣之填海區，而直抵屯門市鎮之中心。



Scale 1 : 50 000
Extract from Crown Lands and Survey Office Map.

ROAD CARRIAGEWAY

Tuen Mun Road will have two three-lane carriageways separated by a central reserve and bounded by relatively narrow verges and hard strips. Until the second carriageway is opened, the first carriageway will carry two-way traffic.

The road has been designed for a speed of 60 km/hr. At the western end, however, as negligible additional costs were involved a design speed of 80 km/hr has been achieved. The nature of the terrain dictated the use of relatively steep gradients. Initially, traffic will be faced with gradients up to 8% but after the second carriageway is opened the maximum climbing gradient will be reduced to 6%.

The road pavement is generally formed with 250 mm of crushed stone sub-base, 150 mm of bituminous macadam base and 100 mm of asphaltic concrete surfacing. Where formation is rock, the sub-base has been omitted. 125,000 tonnes of sub-base and 135,000 tonnes of bituminous surfacing have been used.

Both sub-surface and surface drainage are provided. Porous drains have been constructed under the road formation whilst covered channels, set flush with the carriageway, drain the surface of the pavement.

Several systems aiding traffic operation and safety have been incorporated in the design of the road. Steel barriers are included in the central reserve and on embankment verges. The complete length of the road will be lit and directional traffic signs will be illuminated. Emergency telephones will be installed on both sides of the road at a spacing of 500 m. Along side-by-side sections of dual carriageway, the central reserve will be broken at intervals by emergency/maintenance crossings.

行車道

屯門公路計有兩條三綫行車路，中央有分隔地帶將來往車輛分開，路旁以狹長之邊緣及硬地為界。在第二條行車路未開放通車前，第一條行車路將供雙程行車用。

該公路是為時速60千米的行車而設計。由於所增費用有限，西端的一段行車路則可供時速80千米的車輛行駛。基於地形關係，有時須採用較為陡峭的坡度，最大之上斜坡度為百分之八，但在第二條行車路開放後，將減為百分之六。

至於該公路的鋪築材料，大致是用 250 毫米碎石作為路基底層，然後再鋪以 150 毫米瀝青碎石及 100 毫米瀝青混凝土作為路面。倘基層本身為岩石則省鋪底層。整條公路共用了 125,000 公噸底層碎石及 135,000 公噸路面瀝青碎石。

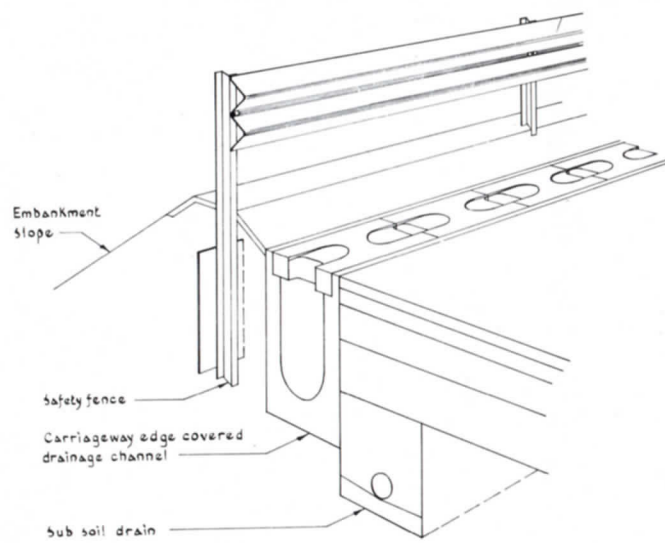
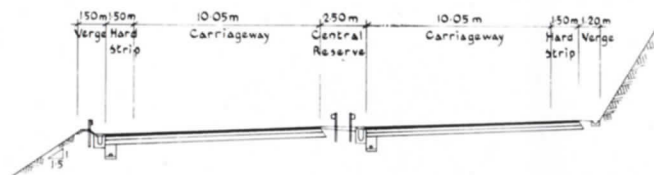
公路的路底及路面均有排水設備。路底設有多孔之排水管道，而路面則設以有蓋排水槽來疏導積水。

公路設有多種交通及安全系統。路中分隔地帶及路堤兩旁築有鐵欄，而整條公路亦設有街燈及照明之方向指示牌。公路兩旁每隔 500 米即設有電話以備發生緊急事件時使用。每隔若干距離，在路中央之分隔地帶，便闢有橫過路口，以供緊急／維修之用。

Top Left : Tuen Mun Road Carriageway Cross-Section
左上圖 屯門公路行車路之斷面圖

Right : Road Paving
右圖 鋪路面之情形

Bottom Left : Carriageway Drainage
左下圖 行車路之排水系統



EARTHWORKS/MARINE WORKS

Difficult topography along the road's alignment has required both major earthworks and marine works. It has been necessary to form cut slopes up to 70 m high and fill slopes as much as 40 m deep in order to fit the road into the hilly terrain. In addition, considerable marine works were needed to cross Tai Lam and Castle Peak Bays and to realign a section of Castle Peak Road.

Cut slopes in soft material are generally flatter near Tsuen Wan than along the remainder of the route because of the finer-grained soil in the Tsuen Wan area. Horizontal drains and rockfill buttresses have been provided at the base of some of these slopes to improve stability.

About half the material excavated has been hard and so several of the slopes have been cut to a near-vertical angle where rock is exposed. These slopes have been stabilised using rock bolts and anchors, horizontal drains and concrete buttresses. Many of the rock slopes were formed using the pre-splitting technique. This technique reduces overbreak during blasting, increases the stability of the slope and gives the exposed rock face a smooth appearance with the pre-splitting drill holes remaining as a feature.

Embankments have been compacted with side slopes of 1 on 1.5. The slopes are protected with grass and chevron-pattern channels. Stepped carriageways have been constructed over a length of some 4.5 km to reduce the size of embankments in side-long ground and to help to blend the road into the landscape.

Little dredging was required for the realignment of Castle Peak Road but some 700,000 cu. metres of mud had to be removed from Tai Lam Bay. The dredged channel has been backfilled with suitable material. The road carriageway is constructed on fill bounded on exposed faces by rock mounds with wave-wall blocks providing additional protection on the seaward side.

The final section across Castle Peak Bay was formed by pumping marine sand directly on top of the original seabed and then constructing an earthfill embankment on this sand blanket.

Top Left : Cut Slopes Ch. 300 – 2000 near Tsuen Wan
左上圖 荃灣附近之挖土斜坡

Top Right : Cut Slope near Siu Lam showing pre-splitting holes
右上圖 小欖附近之挖土斜坡

有關之土方工程及海上工程

由於該路沿綫地形甚為險阻，故須進行大規模土方工程及海上工程。爲了在丘陵地帶建築該路起見，必須開削高達70米之斜坡及鋪築高達40米之填土斜坡。此外，該公路又須進行頗大規模海上工程以便橫跨大欖灣及青山灣，並將青山公路之一段路綫更改。

由於荃灣地區泥土多爲幼粒，因此，在荃灣附近開削之軟土斜坡通常比該路其他地方所削者較爲平坦。有等斜坡底層並設有平放疏水管及堆石扶壁，使斜坡更臻於穩固。

已挖掘之泥土中，約有一半質地堅硬，因此許多斜坡均已削至近乎垂直角度，並露出石面。該等斜坡均已用石栓及石錨，平放疏水管及混凝土扶壁使其穩固。開鑿石坡時，很多時採用預先分裂法，以減少爆石時過度破碎之情況，使斜坡更形堅固，及露出平滑之石面。採用預先分裂法所遺下之鑽孔，則成爲一種特色。

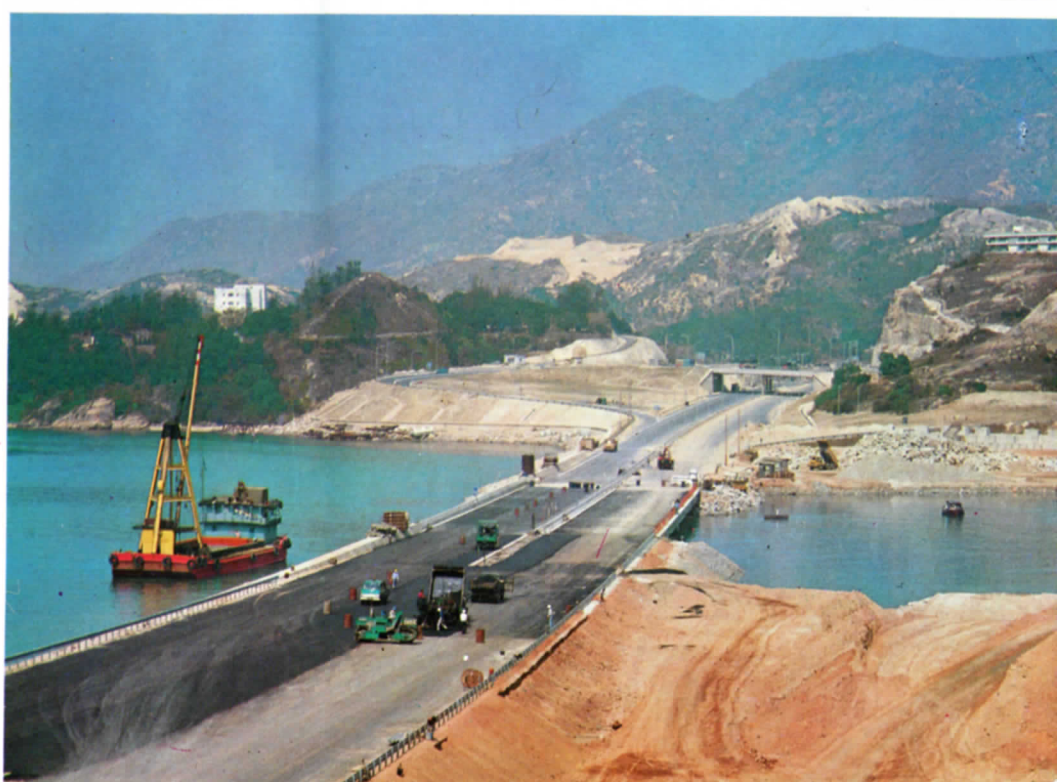
基堤旁邊之斜坡，其坡度爲1比1.5。該等斜坡以草坪保護及用人字形水渠疏水。在長達4千5百米之途程中，建有階梯形之分隔車路，使橫斜地帶上之基堤體積得以縮小，亦可令該路有助於增添鄰近山光水色之美景。

將青山公路路綫修改時，祇須進行小規模之挖泥工程，惟在大欖灣則挖去700,000立方米泥土。已挖泥之坑道則以適當之泥土填回。公路則建於填土之上，兩旁露出之表面，均以石堆封固，朝海一面，則更以石塊所築成之擋波牆加強保護。

橫過青山灣之最後一段道路，其建造法是將海沙直接泵至海床，然後於該沙層上建造填土基堤，以便築路。

Bottom Left : Embankment Ch. 5300 – 5400 near Sham Tseng
左下圖 深井附近之路堤

Bottom Right : Tai Lam Bay and Interchange Ch. 10600 – 11400
右下圖 大欖灣及小欖交匯處



STRUCTURES

Ten road bridges, three footbridges, twelve underpasses and fifteen box culverts have been constructed.

Most of the road bridges had to be built at relatively inaccessible locations and so light-weight pre-tensioned concrete beams were chosen. These beams are supported on columns founded on spread footings, prestressed concrete piles or hand-dug caissons. Because of the topography, several of the columns are very tall, with the tallest at Tsing Lung Tau being 33 m high. A notable aspect of the construction of these tall columns has been the contractor's use of the slipforming technique.

As access was easier at Sham Tseng, longer and heavier post-tensioned beams were chosen for the viaduct. The span of 32 m for this viaduct was dictated by the width of the nullah flowing through the village. Construction of the viaduct required relocation of a substantial section of the old village, and new housing has been provided nearby.

No pedestrian access is allowed onto Tuen Mun Road and no vehicle access to the road is provided between the interchanges. Thus underpasses and footbridges had to be built to connect Castle Peak Road to developments located north of Tuen Mun Road. The underpasses are in-situ reinforced-concrete box structures whilst the design of the footbridges has had to be varied to suit the terrain: one is an in-situ concrete arch and the other two have in-situ prestressed-concrete decks.

混凝土建築物

該公路計有十條行車橋，三條行人天橋，十條行車隧道及十五條盒形暗渠。

大部份行車橋是建於較為險峻的地區，故須選用較輕的預應力混凝土樑。該等樑是架於石屎柱之上，地基分為闊地腳，預應力混凝土樁及人工挖掘沈箱等三種。鑑於該處地形，所用石屎柱頗為高大，最高的一條位於青龍頭，約33米高。建築商建造石屎柱所採用的滑模技術最為令人矚目。

由於深井地勢不若其他地方險峻，該段道路便選用較重的後張混凝土樑以興建高架橋，而該橋每個橋墩則須距離32米，以便橫越流經該村之水坑。為興建設橋，政府須將原有村落的大部份居民遷徙，並在附近地區建築新屋宇將其安置。

因為屯門公路不准行人使用，而車輛亦祇可在交匯處駛入該公路，所以必須築設行車隧道及行人天橋，以便將青山道與屯門公路以北的發展地區連接。行車隧道的設計是原地建造鋼筋混凝土的盒形結構。行人天橋的設計則須配合該處的地形：其中一座為原地建造混凝土拱橋，而另兩座則為原地建造預應力混凝土橋。

- | | |
|--------------------|------------------------------------|
| Top Left
左上圖 | : Sham Tseng Viaduct
深井橋 |
| Bottom Left
左下圖 | : Footbridge, Ch. 5100
深井前之行人天橋 |
| Right
右圖 | : Tsing Lung Tau Bridge
青龍頭橋 |



