

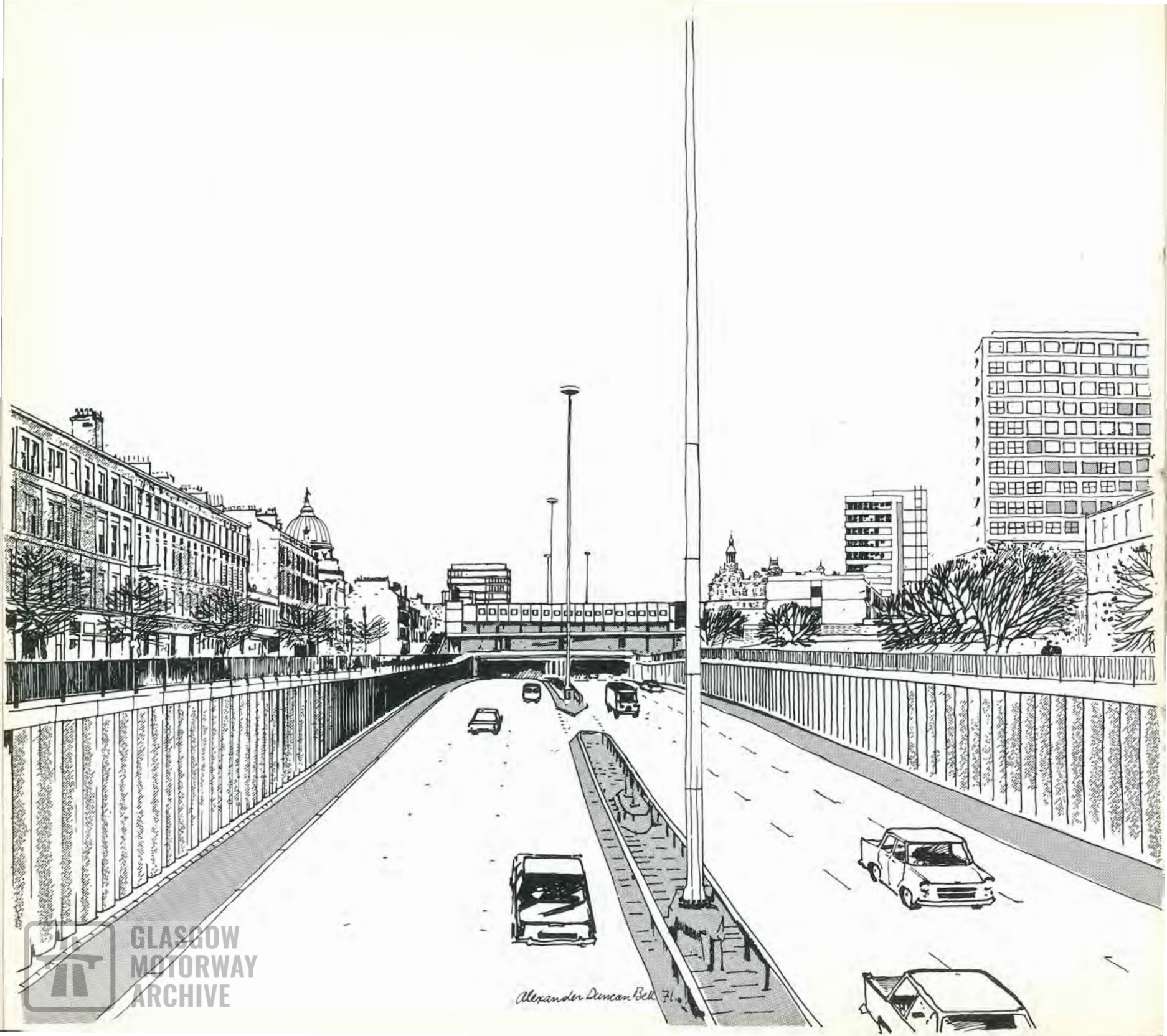
CHARING CROSS

GLASGOW INNER RING ROAD NORTH AND WEST FLANKS



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Alexander Duncan Bell 71.



THE CORPORATION OF THE CITY OF GLASGOW

Souvenir Brochure

of the

OPENING of

**THE NORTH and WEST FLANKS
of
THE INNER RING ROAD**

by

The Rt. Hon. GORDON CAMPBELL, M.C., M.P.,

Secretary of State for Scotland,

on

4th February, 1972



The Rt. Hon. GORDON CAMPBELL, M.C., M.P.
Secretary of State for Scotland



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NORTH FLANK

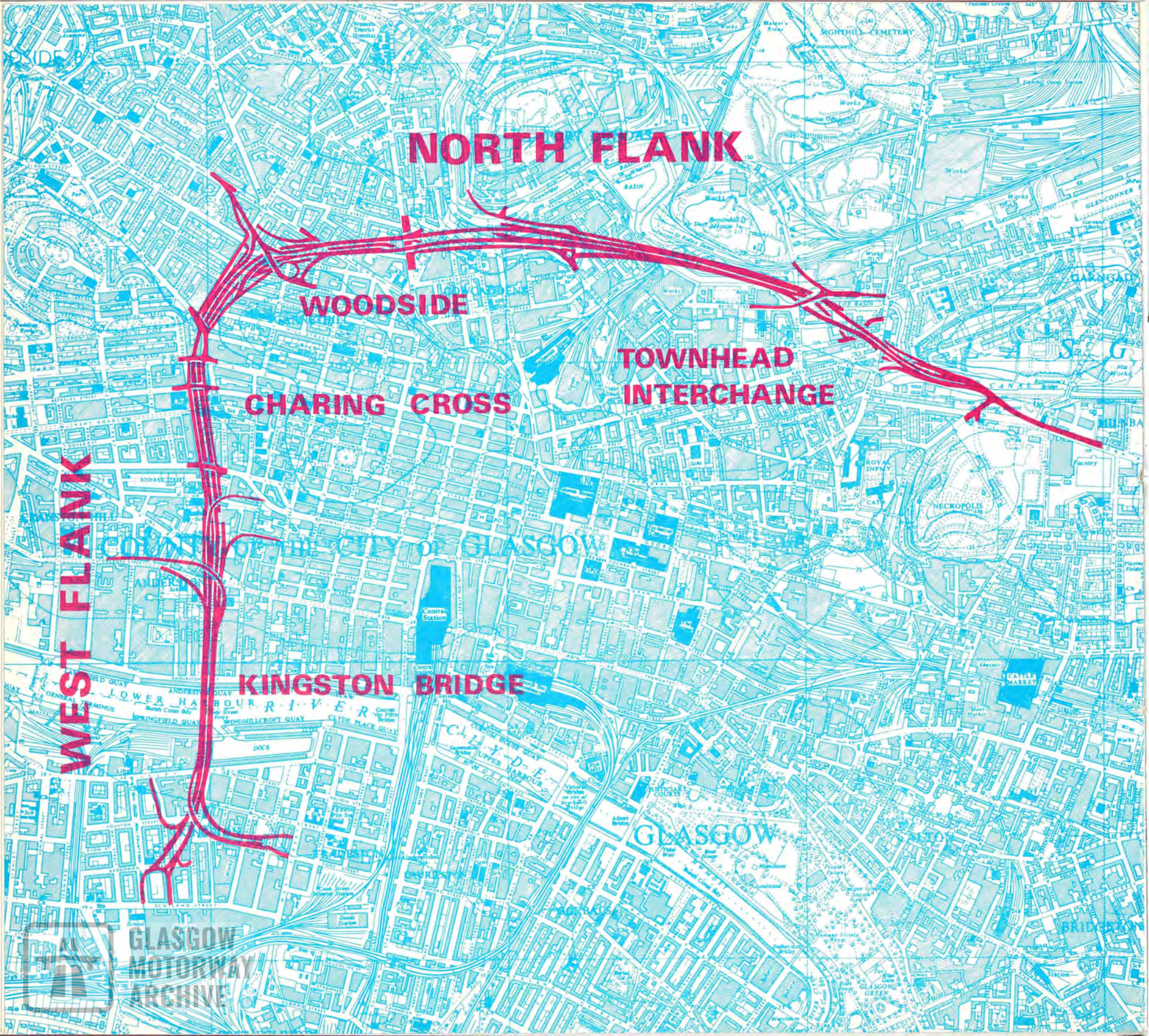
WOODSIDE

TOWNHEAD
INTERCHANGE

CHARING CROSS

WEST FLANK

KINGSTON BRIDGE



Inner Ring Road—North and West Flanks

The North and West Flanks of the Inner Ring Road have been constructed in four major contracts, the last of which, the Charing Cross Section, is now to be opened to traffic. This final project integrates the other three into a completed by-pass of the City Centre to form the first part of a continuous motorway route from east to west through Glasgow, which is the major element in the 1975 highway target programme.

Glasgow is engaged upon a massive programme of redevelopment of areas of sub-standard or obsolescent housing, commerce and industry. This programme was approved in the 1960's. It includes ten Comprehensive Development Areas forming an almost complete ring around the City Centre, which created the opportunity to build an Inner Ring Road to solve the growing central area traffic problems.

In 1960 Scott Wilson Kirkpatrick and Partners were appointed Traffic Consultants to advise on and prepare definitive designs for such a road. Their reports were submitted to the Corporation in 1962, and in 1965 when the Corporation approved the construction of the North and West Flanks of the Inner Ring Road. Thereafter, Scott Wilson Kirkpatrick and Partners were appointed Consulting Engineers for the detailed design of the North Flank, in two major sections. The first stage of the Townhead Interchange was the first of the four major contracts. This work commenced in December, 1965 and was completed and opened to traffic in April, 1968. The Woodside Section completed the North Flank, when it was opened in May, 1971.

W. A. Fairhurst and Partners (who had previously been asked to report on the engineering feasibility of a bridge over the River Clyde at Kingston) were appointed Consulting Engineers in 1962 and were instructed to proceed with the detailed design of the bridge and its approaches as an integral part of the West Flank of the Inner Ring Road. Their remit was further extended to include the design of the whole of the West Flank. The Kingston Bridge and its approaches were opened in June 1970 by Her Majesty the Queen Mother.

The construction period for this major phase of the Highway Plan for Glasgow has, therefore, lasted just over six years from December, 1965 to January, 1972. From conception to completion there has been a period of over ten years. These long time spans indicate how slow is the process of urban redevelopment, involving an enormous amount of rehousing, and relocation of industry and commercial undertakings, the success of which depends upon the co-operation of many Departments of the Corporation.

Today the opening of the Charing Cross Section will release more of the potential traffic capacity of the previous three sections. This will not only facilitate traffic flows on the Inner Ring Road but it will also improve the Central Area environment by re-routing traffic away from City Centre streets.

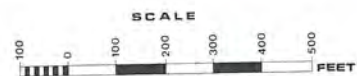
The total length of the North and West Flanks is approximately $2\frac{1}{2}$ miles, and the cost to date totals £26·893m. including £21·269m. for construction work and £5·624m. for land. Alterations to Public Utility Services have formed a high element of cost, amounting to almost £850,000. In the Charing Cross Section, Highway powers were used for the acquisition of land and properties. The major part of the route however, passed through Townhead, Woodside, Cowcaddens and Anderston Cross Comprehensive Development Areas where the Planning Acts were applied for this purpose. The total number of houses demolished by the Corporation Building Department was 4,481.





- KEY
- MOTORWAY
 - NEW SURFACE STREETS
 - NEW FOOTPATHS

**GLASGOW INNER RING ROAD
CHARING CROSS SECTION**



Looking North to St. Vincent Street Bridge



CHARING CROSS SECTION

Introduction :

The opening of the Charing Cross Section of the Inner Ring Road brings to a conclusion the first major stage of Glasgow's Highway Plan. This three-quarter mile length of the West Flank links the Kingston Bridge to the two stages of the North Flank (Townhead and Woodside) already constructed, to give an L-shaped by-pass to the City Centre.

Set between the steeply rising ground of the Park Circus and Garnethill areas, the site has a very prominent position in the City among fine Victorian buildings and the new private developments currently taking shape. Charing Cross itself has always been one of the landmarks well known to many generations of Glaswegians. It has seen many changes of form in its time but perhaps none so radical as the present transformation.

The Problems :

In many ways this particular contract has been one of the most demanding urban motorway projects so far undertaken in the United Kingdom. Its location—through one of Glasgow's busiest commercial areas—has meant coping with heavy volumes of both vehicular and pedestrian traffic at all stages of construction. This, together with the problems posed by dealing with a multiplicity of services, working close to existing buildings, limited working space, varying ground conditions, noise, dust and vibrations, etc. has necessitated extremely careful planning and attention to detail on the part of both the Engineer and the Contractor at all times.



Charing Cross Tunnel—North Portal

Planning and Layout :

The motorway geometry was determined by the need to link to the interchange at St. George's Cross and to the Kingston Bridge Approaches and to make use of the existing North Street as a longitudinal surface distributor road. The original surface street pattern at Charing Cross has been modified to improve the flow of traffic and to cater for motorway access.

The alternative possibilities of constructing the motorway in an elevated form or in a cutting between retaining walls were investigated and costed. The former would have been slightly less expensive—mainly because of the lesser impact on services. However, when the importance and general amenity of the area as a whole, and buildings such as the Mitchell Library in particular, were taken into account, a depressed form proved more acceptable.

The Inner Ring Road is designed to urban motorway standards with an operating speed of 50 m.p.h.



Anchored Retaining Walls

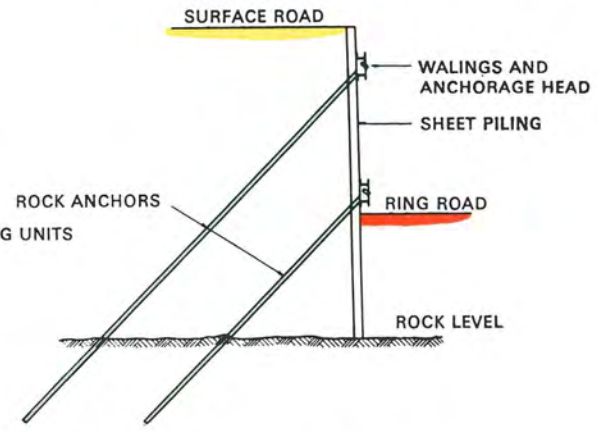
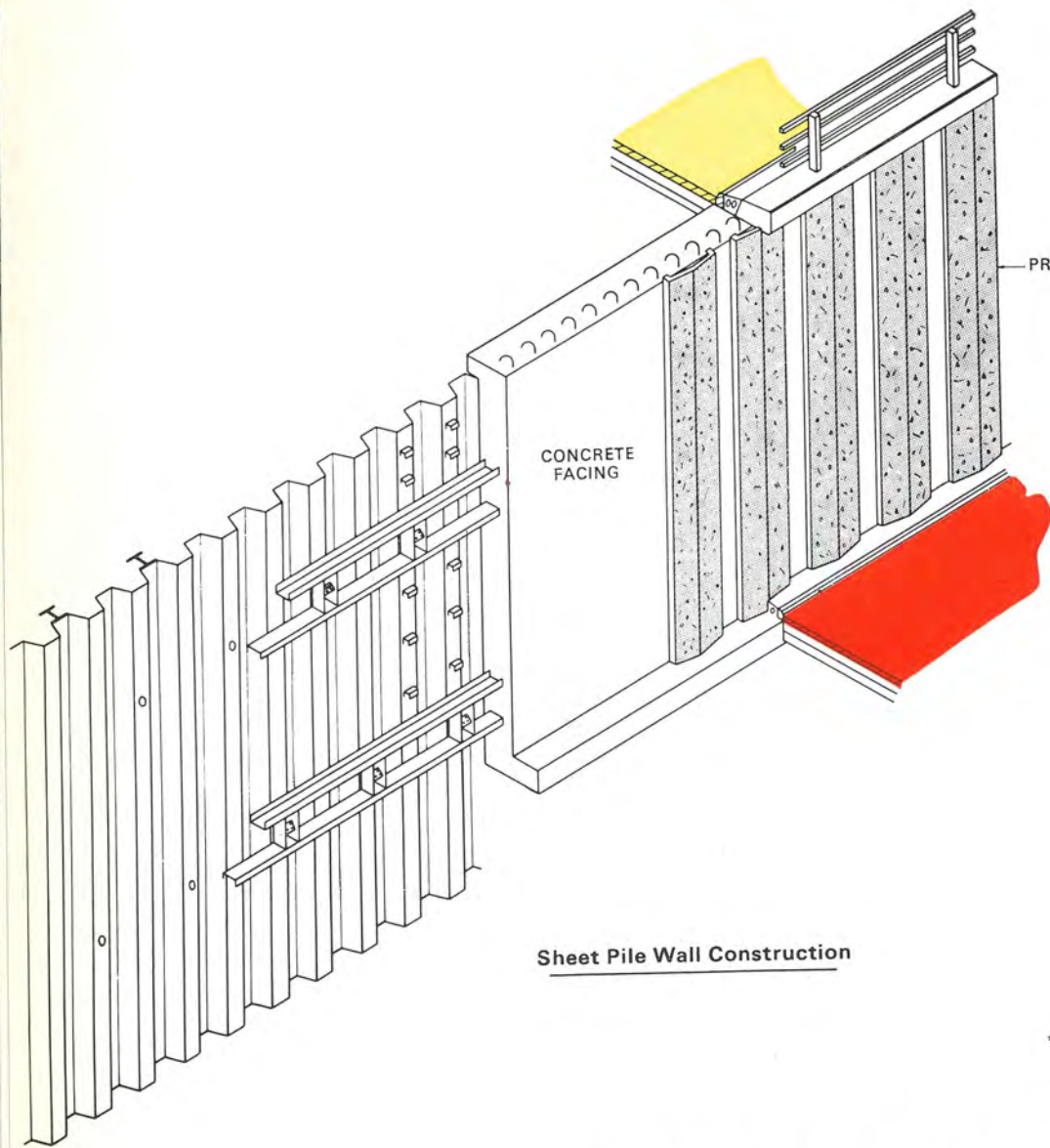


Retaining Walls:

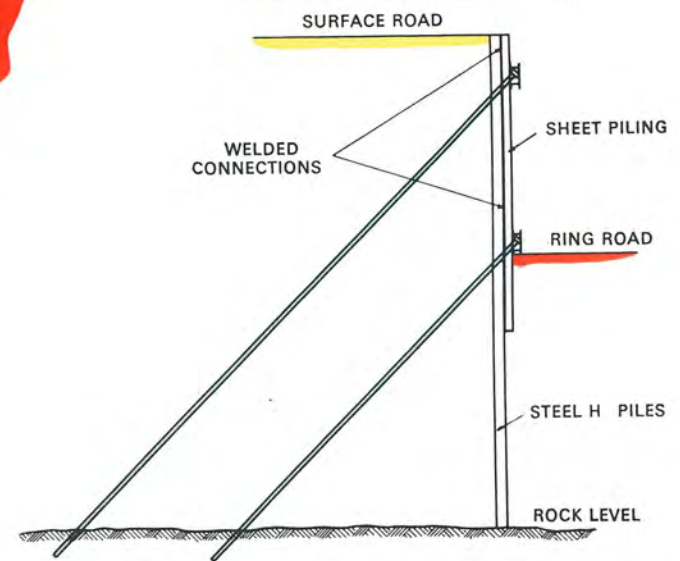
Contrary to what is the case on most contracts, here the retaining walls provide much of the interest. Many of the walls are of conventional reinforced concrete construction. The main interest lies in the motorway retaining walls which are somewhat unusual in their design. Sheet pile walls-with rock anchors have been used on several occasions as a temporary construction expedient, particularly in deep basement constructions. Their use, however, as permanent walls is much more limited. The advantage, in this case, of minimising the construction effects on services, traffic and existing buildings showed considerable savings.

Since high levels of noise and vibration could not be tolerated, the Taylor Woodrow Pilemaster was used to drive the 2,500 tons of steel sheet piling on the Contract. This piling is of 3N or 4N section, much of it in high yield steel. For the majority of the walls two rows of rock anchors have been driven. The anchors (which were formed for the main contractor by Foundation Engineering Limited) comprise tendons, with load capacities up to 126 tons, of p.v.c. covered, grease filled, $\frac{1}{2}$ " diameter Dyform strand. The specially fabricated anchorage head is incorporated in double channel continuous walings. *In situ* concrete and shaped precast facing panels give the walls an acceptable finished appearance.





Type I Sheet Piling to Rock



Type II Steel H Piles to Rock

Details of Anchored Retaining Walls

St. George's Cross Interchange



Bridge Structures :

The Contract has a large structural content. Apart from the long lengths of retaining walls, there are several bridge structures, all of which had their own particular demands.

Limited track possession times dictated that the busy electrified low level railway at Charing Cross Station had to be bridged with precast prestressed beams. These box beams are 80 ft. in length and bridge the track on two levels—one for the motorway itself and the other for a parallel surface street.

Two of the motorway ramps are carried on *in situ* prestressed concrete box structures. One of these is a 5 × 60 feet span viaduct and the other a varying depth bridge on two spans of 54 feet and 120 feet.

The Bath Street Bridge and the tunnel which carries the complex of surface streets at Charing Cross are of reinforced concrete slab construction incorporating the miscellany of service pipes and cables which are inevitably a feature of this type of work. The 450 feet long tunnel, built in "cut and cover", was constructed in three defined stages to suit traffic and service layouts. The walls are finished in white mosaic tiles, the roof has a dark blue painted finish and lighting is provided by cornice mounted fittings. The cost of the tunnel and associated works was around £ $\frac{1}{2}$ m.

Pedestrians and vehicles will ultimately be carried on separate grades at Charing Cross and the first two of the necessary footbridges were included in this Contract. A five span bridge in prestressed concrete links Woodside Terrace and Woodlands Road with Renfrew Street. On the south side of Sauchiehall Street, a 50 feet wide slab, spanning the Ring Road and surface streets, will eventually carry a two-storey development and a walkway.

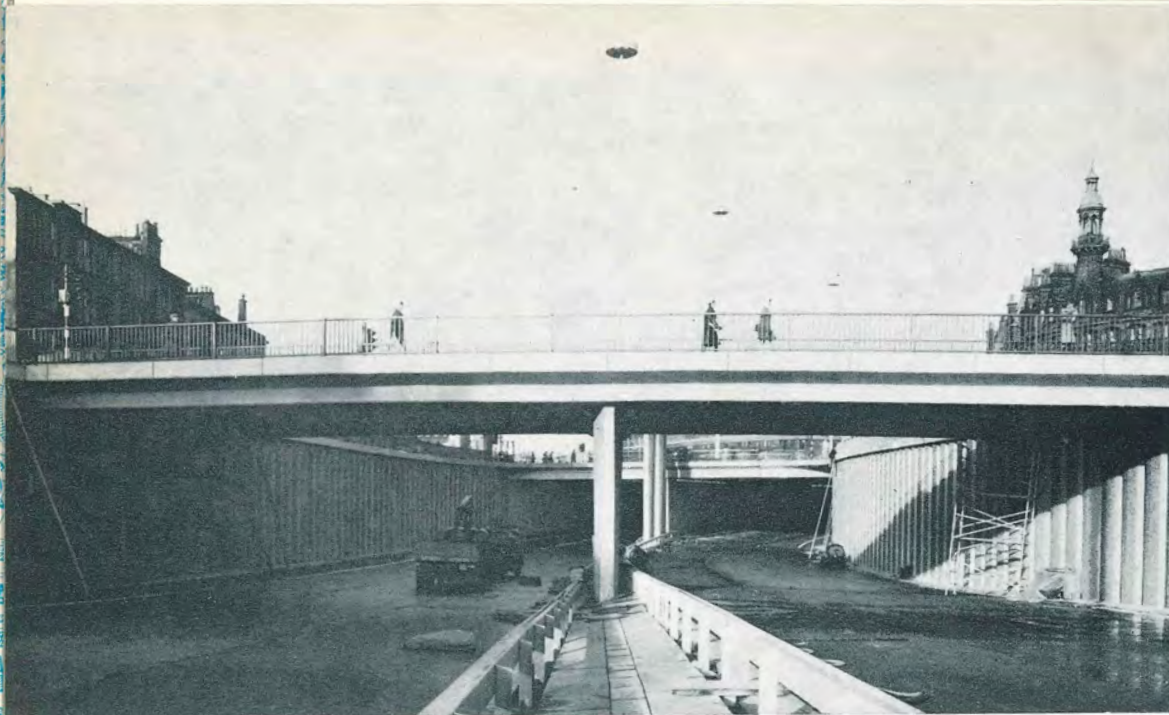


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Bath Street Bridge



Road Surfacing and Finishes :

Road construction comprises either a flexible base of bituminous macadam, a concrete base or a regulating concrete layer on rock, the form depending on the type of sub-strata which varies along the length of the Contract. The running surface consists of 4 inches of hot rolled asphalt placed in two layers.

Most of the lighting is obtained from lanterns on 100 feet high masts and ramp heating is provided on ramps where the gradient exceeds 5 per cent.

Recent attention to safety standards on high capacity motorways, together with the need to protect "obstructions" in the central reservation, have led to the adoption of a median barrier of an unusual form. The barrier, which is designed to flex, under impact, as a longitudinally tensioned rail, comprises a steel box section with weak post to rail connections.

Major signs on the motorway are of the internally illuminated gantry type evolved for use on the whole motorway system.

The finishes to the structures and other works have been chosen to minimise maintenance costs and to accord with the importance of the location of the Works. The final appearance will be enhanced by the landscaping works to be carried out by the main contractor and the Corporation's Parks Department.



Property Acquisition and Accommodation Works :

Major properties acquired for the Contract included the Grand Hotel, Elder's Furniture Showrooms, the St. Andrew's Ambulance Building and the Charing Cross Station Booking Office and entrance. Prior to the Contract, the ambulance depot was relocated in Cowcaddens and the new railway station building constructed as part of the first phase of the Charing Cross Development.

Costs :

Construction costs amounted to almost £4m while property acquisition, compensation and other costs brought the total to over £6m. The Contract qualified for a 75 per cent grant from the Scottish Development Department and the remainder has been financed directly by the Corporation of Glasgow.

Principal Agents :

Master of Works and City Engineer
Consulting Engineers
Consulting Landscape Architects
Main Contractor

John Armour, C. Eng., F.I.C.E., F.I.Mun.E., F.R.T.P.I.
W. A. Fairhurst and Partners.
William Holford and Associates (Glasgow).
Whatlings Limited.

Principal Sub-Contractors and Suppliers :

SUB-CONTRACTORS

Tunnel Sewer—
Fram-Drysdale Ltd.
Rock Anchor Work—
Foundation Engineering Ltd.
Steelfixing—
Progressive Reinforcement Services Ltd.
Sheet Piling—
Taylor Woodrow Construction Ltd.
Median Barrier & Balustrading—
Westcott Engineering Services Ltd.
Surfacing, Famliner—
Geo. Wimpey Asphalt Ltd.

High Mast Lighting—
Concrete Utilities Ltd.
Beams for Charing Cross Station—
Dow-mac Concrete Ltd.
Ramp Heating, Lighting & Emerg. Tel. Boxes—
Edmiston Brown & Co. Ltd.
Gantry Signs—
Franco Signs Ltd.
Mosaic work to tunnel—
Proctor & Lavender Claddings Ltd.

SUPPLIERS—

Precast Concrete Cladding Units—
Aberdeen Concrete Co. Ltd.

Reinforcement—
British Steel Corporation

Sheet & "H" Piles—
British Steel Piling Co. Ltd.

Bulk & Bagged Cement—
Clyde Cement Ltd.

Aggregates, Concrete Sand and Building Sand—
Springbank Quarry Co. Ltd.

Prestressing Strand—
C.C.L. Systems Ltd.

Bridge Bearings and Expansion Joints—
McLellan Rubber Co. Ltd.





*Aerial View
of
Kingston Bridge
and
Approaches*



Kingston Bridge Looking Upstream



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KINGSTON BRIDGE and APPROACHES

The Kingston Bridge Section of the West Flank was opened by Her Majesty the Queen Mother on 26th June, 1970. Its immediate effect has been to relieve traffic congestion on the existing city bridges. Traffic volumes on it have risen steadily to approximately 42,000 vehicles per day. The completion of the North and West Flanks, as a by-pass to the city centre, will bring an immediate increase in the use of the multi-lanes of Kingston Bridge.

The main river bridge, carrying five lanes of traffic in each direction, comprises a three-span prestressed concrete structure with spans of 205, 470 and 205 feet. It was built in "free cantilever" to give minimum navigational clearance of 60 feet at all stages of construction.

The three miles of elevated motorway and ramps leading to the Kingston Bridge were constructed mainly of *in situ* prestressed concrete. The need for a structure which would have an elegant appearance, despite the large number of columns necessary to support it, led to the adoption of a double tapered shape for these columns. The slender appearance of the ramp structures was obtained in an unusual way by linking sections together by hydraulic dampers.

Parts of the areas below the elevated motorway are laid out to accommodate new surface streets and car parking. The remaining areas are finished in patterned paving. Outwith the structures extensive planting of grass, shrubs and trees has been undertaken.

The Institute of Structural Engineers recognised the project with the presentation to the designers of its Special Award for 1971. Particular mention was made, in the citation, of the structural form, attention to detail and the open parkland created around it.





Plate No. 1
Aerial View
of
Woodside Section

WOODSIDE SECTION

The aerial view on Plate 1 shows the Woodside Section from its interchange with Great Western Road at the junction of the North and West Flanks to its connection with the Townhead Interchange Stage I. As with Townhead, the scheme lies almost wholly within areas of new development of which the two most significant are Cowcaddens and Woodside Comprehensive Development Areas. The extensive cleared areas lying to the immediate north of the scheme are in process of redevelopment. The fringe commercial centre of St. George's



Viaduct Over New City Road



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Plate No. 2—Landscaping at Craighall Road—Dobbie's Loan Area

Cross which contains an underground station has been partially by-passed by the new scheme. Final plans for the centre envisage complete pedestrianisation with sufficient parking to provide a useful "park and ride" service via the underground to the centre. The station reception area and entrance have been rebuilt with this proposal in mind.

As with Townhead, a great deal of the complexity of Woodside was necessitated by provision for a future interchange, in this case the connection of the proposed Maryhill Motorway to the North Flank. The area cleared for this interchange can be seen in the aerial view on Plate 1 as can also the ramp platform from which the north carriageway of the North Flank will be extended into the Maryhill Motorway. Woodside consists of about

4,000 feet of dual carriageway motorway, and about 3,500 feet of surface streets, together with seven vehicular bridges (including two viaducts) two footbridges, two pedestrian subways and eleven retaining walls.

The viaduct sections are respectively 1,200 and 1,500 feet in length and consist of precast post-tensioned beams supported on inverted "T" reinforced concrete pierheads. This form of construction was most consistent with the necessity to maintain traffic on New City Road and Garscube Road, both of which carried heavy traffic flows under the viaduct throughout the contract, and with speed of erection. A feature of the retaining walls was the use of precast exposed aggregate panels as both formwork and permanent finish.

Landscaping :

The same close attention has been paid to the pedestrian system and to landscaping as with Townhead. Again almost all of the contiguous land is in process of or scheduled for redevelopment. While this facilitates a finally more satisfactory integration it creates interim problems. As with Townhead a policy has been followed of installing the maximum of finished landscaping and where disturbance is inevitable in future work, forming and grassing for the interim period. This is regarded as a necessary on-cost if blight is to be avoided. Plate 2 shows a detail of landscaping at Craighall Road—Dobbie's Loan area.

Traffic :

12,500 vehicles per day currently use this section of the North Flank. As with Townhead the redistribution of traffic which will follow the opening of the North Flank will significantly alter the patterns of use and movement.





Plate No. 3
Aerial View of
Townhead Interchange

TOWNHEAD INTERCHANGE Stage 1

The aerial view on Plate 3 shows the relation of Stage I of the Townhead Interchange to surrounding development and redevelopment, and provides a general view of the project and its associated landscaping. The Interchange will finally be almost entirely contained by new developments since much of it lies within the Townhead Comprehensive Development and it also fringes upon the Royston C.D.A., the Royal Infirmary redevelopment and the Sighthill development.



Plate No. 4—Looking East from Baird Street Bridge

Plate No. 5—Landscaping—Looking North through Baird Street Bridge

This scheme is the first stage of the Interchange formed by the junction of the Springburn Expressway which is proposed for completion by 1980, the Monkland Motorway, with a proposed start in early 1972 for completion by 1976, and the North and East Flanks of the Inner Ring Road due to start about 1980. It consists of about 5,000 feet of dual carriageway over Castle Street which is the main north/south route at the east of the City Centre. On its western extremity it connects with the Woodside Section of the North Flank and, on its eastern extremity through a temporary ramp to Alexandra Parade and thence to the Edinburgh Road.

The complexity of Stage I derived not from its current function but from the provision for its future extension which necessitated the construction of ten bridges, six pedestrian subways and thirteen retaining walls. Where possible, structures provided for future works were brought into immediate use by temporary connections. Plate 4 shows such a connection taken through a bridge provided in advance for the through carriageways of the East Flank of the Ring Road.



Landscaping :

One of the major problems in landscaping Townhead was the temporary treatment of areas cleared in advance for future works. Where possible final landscaping treatment was incorporated, elsewhere if disturbance was deemed to be unavoidable in implementing the future works the affected areas were temporarily formed and grassed. Plate 5 shows a detail of landscaping at the area on the South side of Baird Street Bridge.

A feature of the landscaping was the footpath system. This cannot be fully developed until the completion of the whole interchange, but already 5,600 feet of paths, independent of those immediately alongside surface streets, interconnect the underpasses and footbridges. This has been planned as a deliberate attempt to open, rather than sterilise, the area of the interchange.

Traffic :

The initial traffic flows on the Townhead Section of the North Flank were measured in 1968 at 14,000 vehicles per day as compared to the predicted figure of 19,000 vehicles per day. This flow increased to 24,000 vehicles per day following the opening of the Woodside Section in May, 1971. It is anticipated that a substantial re-orientation of traffic currently existing at Castle Street will follow from the opening of the Charing Cross Section.



Edinburgh M8
Charing X

City Centre

Partick

City Centre
A 814



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THE URBAN MOTORWAY and the ENVIRONMENT

There are two aspects of a motorway route in an urban setting :

- (i) Its effect on the environment of the area through which it passes as seen by the pedestrian ;
- (ii) Its appearance and relationship to the general urban structure as seen by the motorway driver.

Consideration requires to be given to a broad planning strategy which can be formulated and implemented to match the motorway construction programme. If the opportunity is taken and with imaginative skill in the planning stage, a motorway can enhance the urban form.

Alignment :

The scale of a modern motorway is so vast, and its visual direction so powerful, that it cannot be considered as secondary to its surroundings ; in its siting careful attention must be given to the existing city structure and the redevelopment programme. Special care must be given to the effect a motorway may have on any civic or historic areas of the City, and where it is located in close proximity to historic buildings it should be realigned or depressed. The extra cost which may be involved by such a change in construction must be met if the environmental qualities of historic areas are to be conserved.

The Charing Cross Section has been depressed through this sector of the City to afford an opportunity, not merely to retain the existing characteristics of the area, but also to improve environmentally an area which is not scheduled for comprehensive redevelopment.

Pedestrian Movement :

Where the land use distribution generates major pedestrian movements which traverse the motorway, care has to be taken that the scale of the pedestrian route is not overpowered by the motorway. The difference between a pedestrian route which can be appreciated at 3 m.p.h. and a vehicular route which can be appreciated at motorway speeds is considerable. It is essential that within the landscape pattern proposed, an open space allocation for the transition between the differing scales of development is sufficient.

Pedestrian and vehicular segregation is clearly required due to the heavy traffic conditions which will be experienced in the future development in this section of the City. Quite apart from the obvious desirability of fulfilling the principles of good design, pedestrians should not traverse the Charing Cross intersection at street level.

Landscaping :

The treatment of new land forms created by the motorway has been governed by the need to provide on the one hand a broad diverse and sweeping landscape for the motorist, as provided through the Townhead Interchange, and on the other, landscape which in its detail merges sympathetically with the adjoining land form.

In this connection, space has been made available on the North Flank as it approaches the Charing Cross area to provide a degree of space in order that a visual intrusion is created by the land uses adjoining the motorway.

However, in the Charing Cross area, the vertical profile of the motorway has been depressed below surface street level, with an opportunity to maintain as much of the character of the area as possible and also to landscape the area of Garnethill on the east.

In order to soften the impact of the new development through this busy pedestrian area, detailed landscaping has been carried out on the surface street pattern.





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