THE CORPORATION OF THE CITY OF GLASGOW

Souvenir Brochure

of the

OPENING of

CLYDESIDE EXPRESSWAY

by

The Lady Provost Mrs. MARY GRAY, M.A., M.Ed.

on

27th APRIL, 1973

THE LADY PROVOST OF GLASGOW

Mrs. MARY GRAY, M.A. M.Ed.

The Right Honourable The Lord Provost
WILLIAM S. GRAY, Esq., J.P., B.L.

Councillor THOMAS FULTON, J.P., *Convener*

THE CORPORATION OF THE CITY OF GLASGOW
HIGHWAYS COMMITTEE 1972-73

The Right Honourable The Lord Provost
WILLIAM S. GRAY, Esq., J.P., B.L.

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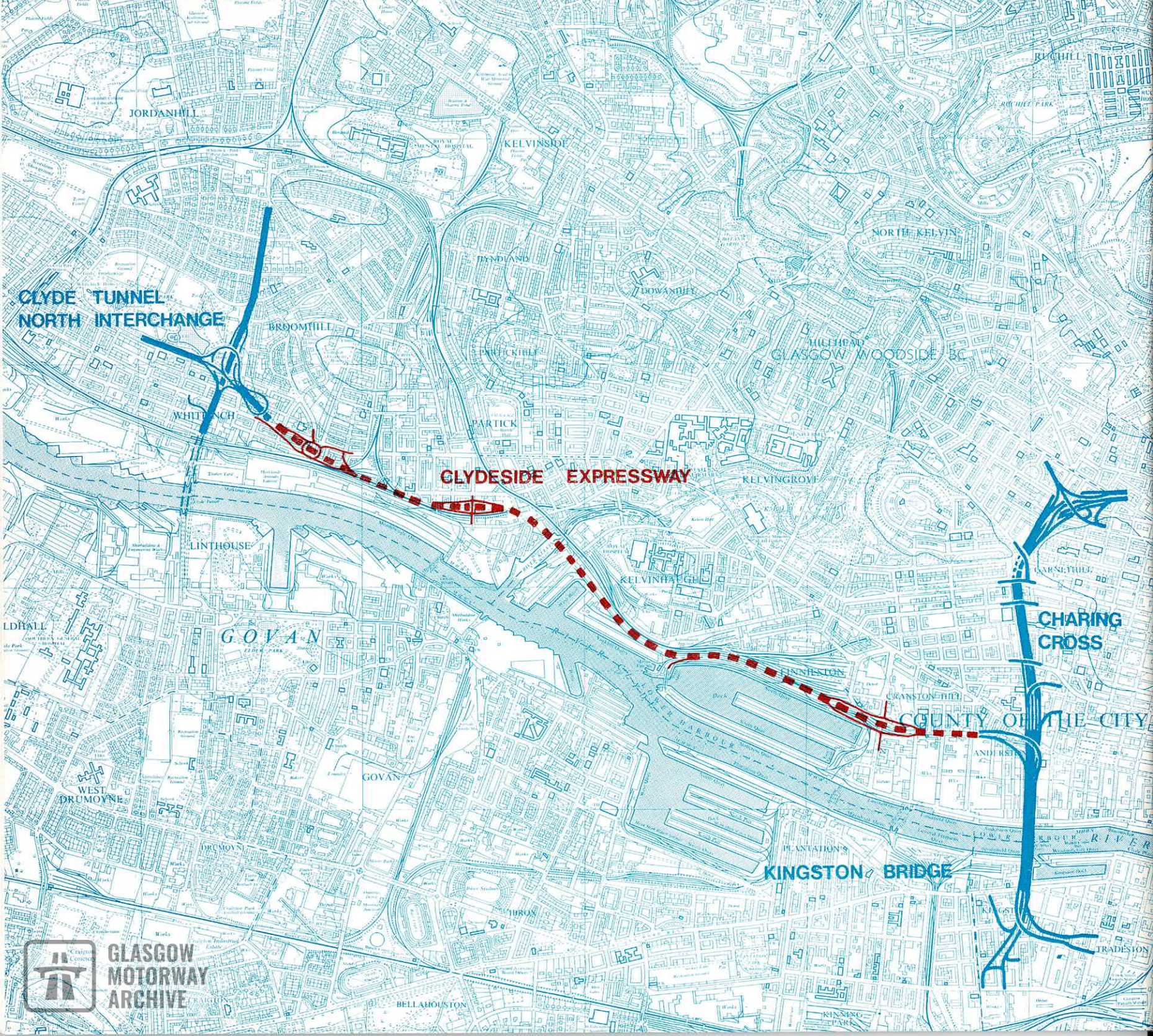


Introduction :

The commissioning of the Clydeside Expressway marks the completion of the first of the new radial roadways proposed under the City's Highway Plan. More important, however, is its function in connecting the Anderston intersection of the Inner Ring Road with the North Approach to the Clyde Tunnel. In so doing, the major works of the North and West flanks of the Ring Road, completed in February, 1972, become integrated with the Clyde Tunnel which was completed some ten years ago.

In September 1967 Sir William Halcrow & Partners were engaged as Consulting Engineers for the Clydeside Expressway.

General Description :

The Expressway lies along the north bank of the River Clyde. At its western extremity, it joins into the directional interchange at the north end of the Clyde Tunnel. Along most of its length, the Expressway passes through industrial development and lies within or fringes on areas in Whiteinch and Partick scheduled for comprehensive redevelopment and its detailed design allows for the future plans of these areas. It is connected to the Inner Ring Road at Anderston by directional ramps for the east/south direction and diamond type ramps for east/north traffic. It consists of dual two-lane carriageways with three grade-separated interchanges at Sawmill Road, Hayburn Street and Finnieston Street, and one surface level intersection at Ferry Road. The total length of the Expressway is 3·54 km. The contract, valued at £3·59m., was let to Balfour Beatty & Co. Ltd., in March 1971.

The Project : Restraints and Local Service Requirements

A number of restraints applied along the proposed route and two of these were the rationalisation of British Rail services in the area, and the Clyde Port Authority's future intentions for Queen's Dock and Yorkhill Quay.

A goods line only alongside South Street and Castlebank Street to serve Meadowside Quay and the oil and metal interests near the former Partick Central Station had to be provided. Elsewhere rail services were abandoned with one notable qualification concerning permanent access to the Stobcross Tunnel in the Finnieston Street area. The Greater Glasgow Transportation Study Group had recommended the re-introduction of the Central Low Level line, requiring a connection between the existing Blue Train Service and the Stobcross Tunnel. Although no decision had been taken to implement the Study Group recommendations it was essential to ensure that the detailed design of the Expressway would in no way frustrate its implementation at a later date.

Information was also available that the Clyde Port Authority had no future plans for operating Queen's Dock. Their Yorkhill Quay was, however, to remain in service as a container depot for an indefinite period. The area occupied by Queen's Dock became of interest as a site for potential development and hence of future traffic generation which, it appeared, could be adequately serviced by a suitable junction at the intersection of the Expressway and Finnieston Street. Yorkhill Quay would remain to be serviced directly from the Expressway while maintaining the existing one-way traffic system of container movement through the dock from East to West.

In the Highway Plan proposals only one grade-separated junction was proposed over the total dual carriageway length of 3·5 km and that at Sawmill Road. Three other junctions were proposed as at-grade light controlled intersections namely at Hayburn Street, Ferry Road and Finnieston Street. From their consideration of the

rationalisation of railway and dock restraints already mentioned and updated traffic assignments arising from the work of the Greater Glasgow Transportation Study Group the Consulting Engineers proposed a number of alterations. A change in the plan alignment between Hayburn Street and the Clyde Tunnel North Approach was made by re-aligning 1.3 km of the railway goods track south of its existing position, and in so doing demolition of the Beith Street Fire Station and reconstruction of the Main Partick Grid Sub-station was avoided.

In the case of the Ferry Road junction the Consultants were of the opinion that the introduction of the grade-separated junction at Hayburn Street diminished the usefulness of a junction with Ferry Road. As the Port Authority wished to continue to operate Yorkhill Quay as a container dock it would be necessary for long vehicles from the dock to join the Expressway at Ferry Road. The traffic envisaged was not high and as a light-controlled junction would impose delays on the major Expressway volumes, a roundabout junction was proposed as a satisfactory interim solution which could readily be modified without undue difficulty should the land use of Yorkhill Quay alter with the passage of time.

The Sawmill Road and Finnieston Street intersections required the Expressway to cross the surface street system by overpass At Hayburn Street, however, for environmental reasons, this section of the Expressway was designed to be in cutting.

Hayburn Street Intersection :

This design proved an economic solution for this junction since the existing railway already crossed beneath. Hayburn Street, and also made it easier to maintain satisfactorily the close proximity of railway and Expressway to the West of Hayburn Street. Two design problems were created, however, by the Expressway being in cutting at this location. Firstly, the tunnels of the City's Underground Railway were only a few metres below the expected level of the roadway and retaining walls had therefore to be founded at a shallow depth. Secondly, the Expressway had to be depressed sufficiently to give statutory headroom to Hayburn Street Bridge. The deck of this bridge has been designed with minimum construction depth to allow a suitable vertical alignment and connection to Beith Street. Notwithstanding, the Expressway road surface in the cutting is only about half a metre above the flood level of the River Clyde, but this is adequately covered by the new surface water sewer discharging to the river.

A little to the East of the Hayburn Intersection the Expressway crosses the railway tunnel carrying the British Rail goods service line already mentioned. The roof of the tunnel was a mixture of metal beams and intermediate brick arches, and this was broken out and replaced with a prestressed concrete deck over the length affected by the new works.

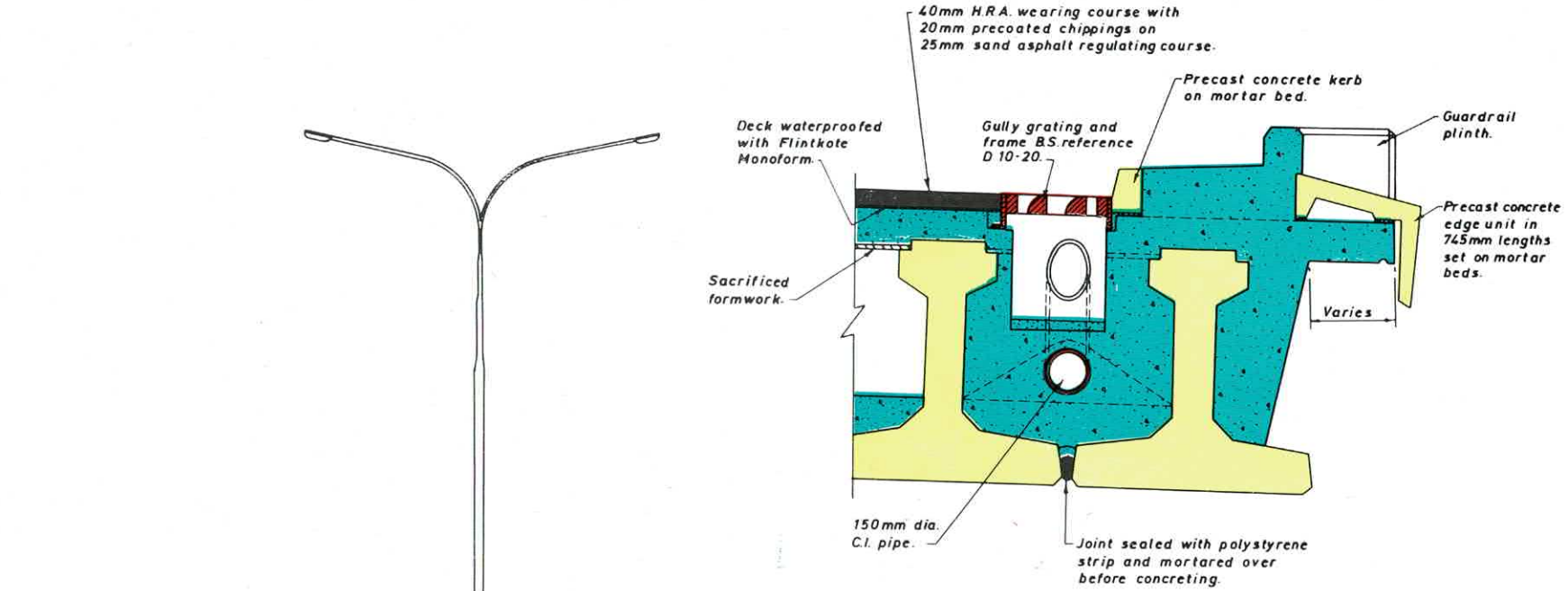
Pointhouse Bridge :

The Expressway crosses the River Kelvin by the Pointhouse Bridge, a steel beam composite slab bridge which was designed by the City Engineer and constructed by H. M. Murray & Co. Ltd. in advance of the Expressway proper.

Finnieston Street Interchange :

The design of the Finnieston Street Interchange proved to be the most demanding technical problem encountered in developing the arrangement of the works.

The site had been the scene of extensive railway engineering works around 1880 and much of the road pavement of Finnieston and Stobcross Street was supported on a decking of wrought iron girders and brick jack arches. Beneath lay extensive disused railway lines which had connections to tunnel systems east and north west of the site. While these services had all been closed down by British Rail it was, as stated earlier, a recommendation of the Greater Glasgow Transportation Study Group that a new electrified passenger service be opened utilising



DETAIL OF EDGE OF DECK

OVERPASS – CROSS SECTION

FIG. 1

Finnieston Overpass

the disused tunnel to the east under Argyle Street and connecting it with the existing Blue Train (North) passenger service to the north west of the site. It therefore became necessary to provide a railway route through the interchange to allow implementation of the recommendation at some future date.

The Expressway had to be carried over Finnieston Street with connecting slip roads between the new road and Finnieston Street. Construction had therefore to be carried out in a confined site of sandwich operations involving:—

(1) Work at the lower level on demolition of old and construction of new railway structures, foundations for highway structures and construction of pedestrian underpasses,

(2) Work at mid-level on bridging the future railway, reinstating Finnieston Street and constructing slip roads,

and

(3) Work at the higher level on the Overpass structure.

The above operations dictated a design requiring no falsework to the spans of the Overpass. In addition the eastern limit of approach to the overpass was limited by the existing railway tunnel and the ramp slips of the Inner Ring Road. It was therefore necessary to achieve a shallow construction depth at the point of crossing Finnieston Street. This in turn would reflect economy in the fill and retaining walls.

Following a detailed economic assessment it was found that simply supported precast prestressed concrete beams to the Cement & Concrete Association's Standard M7, offered the *prima facie* saving over other construction forms. On further refinement of economic, engineering and maintenance considerations, it was found that the shallower M5 beam would be adequate if live load continuity were introduced. This was a more satisfactory solution and detail design proceeded on that basis.

The structure consists of eight intermediate spans utilising 24.55 m long beams and two end spans of 22 m long beams. A cross section and detail of edge of carriageway deck is shown in Fig. 1. Foundation of intermediate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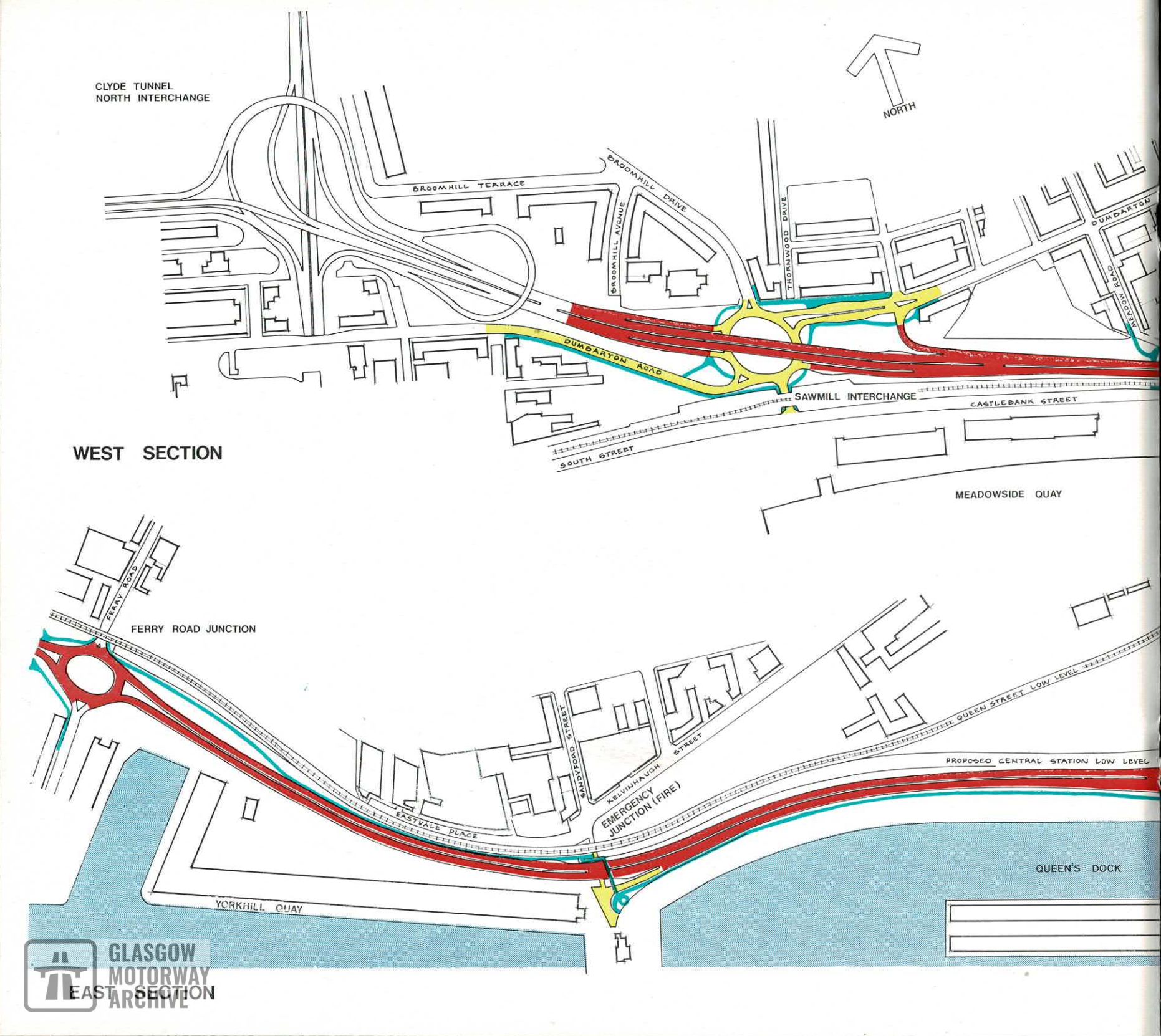
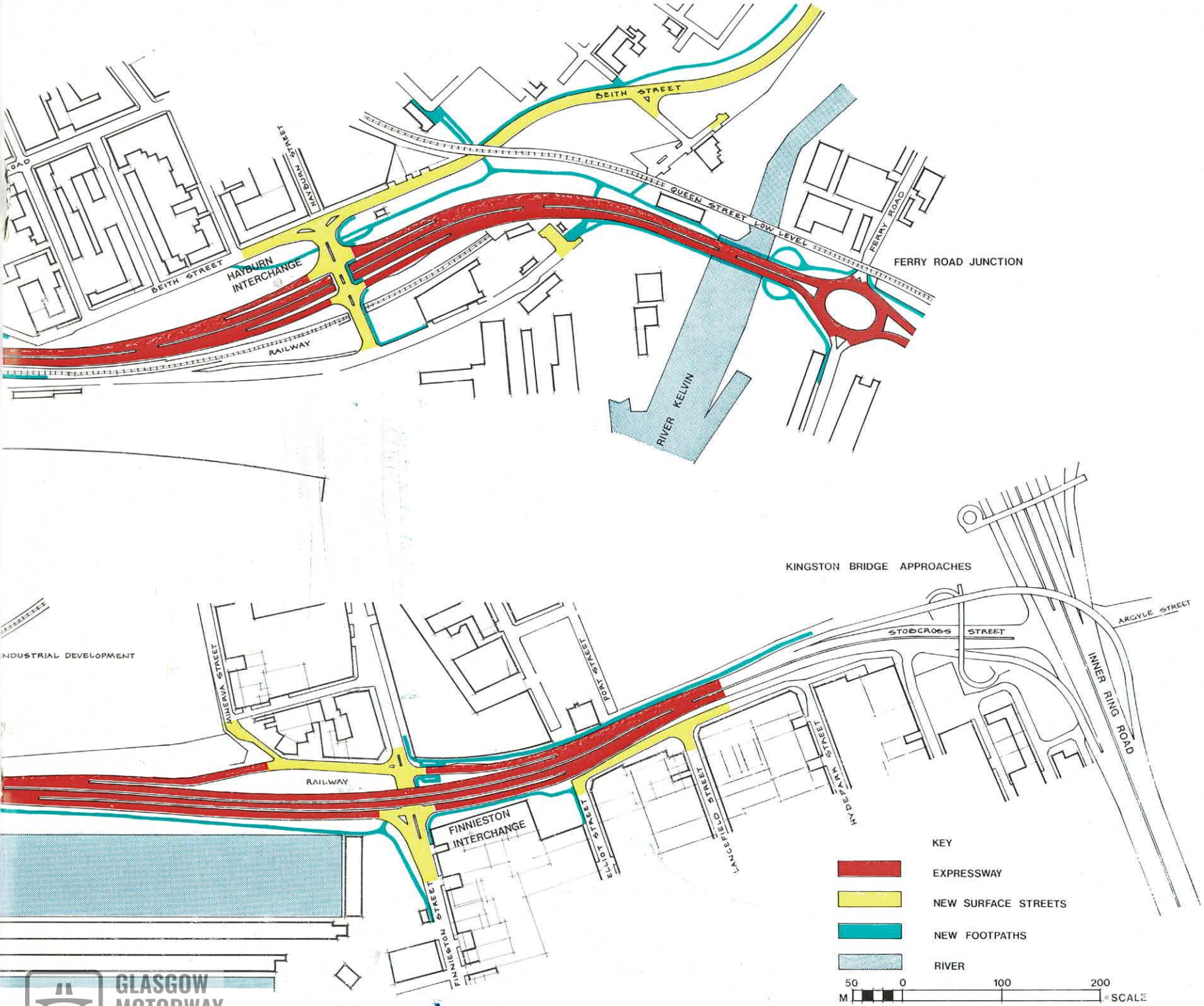




supports consists of 4 No. 1.2 m diameter bored cast *in situ* piles bearing in rock and surmounted by a reinforced concrete pile cap. Two columns rise from the pile cap to the support level of the deck.

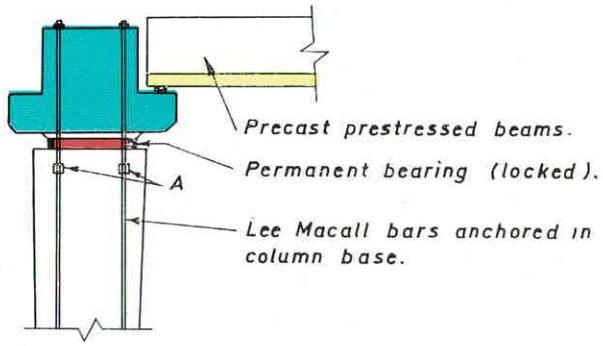
The design required a R.C. crosshead to be constructed on bearings surmounting the pair of columns. Bearings were fabricated to include temporary locking restraints against sliding and rotation and the crosshead was initially stressed against the bearings and columns by coupled Macalloy bars. Beams were then erected on sacrificed rubber pads and virtually all the *in situ* deck concrete was cast while the simply supported condition obtained. Live load continuity was thereafter achieved by casting reinforced concrete around the ends of the beams and the spine of the crosshead within the deck thickness, followed by destressing and removal of Macalloy bars and liberation of bearings in a predetermined sequence. The final continuity joint was at the east abutment where the deck was solidly fixed to the abutment structure. Permanent thermal movement of the ten-span structure is therefore concentrated at the west abutment where a free draining FT200 expansion joint is installed. The sequence of construction is diagrammatically shown in Fig. 2. All drainage west of the vertical curve of the completed deck is to the abutment where it freely discharges into and flushes a transverse drainage channel which also collects leakage and grit passing through the expansion joint.

By virtue of the live load continuity there is no great projection of the crosshead below the soffit of the bridge beams. The edges of the crosshead break the side profile of the beams and subdue the angularity due to chording around the plan curvature. The *in situ* edge concrete to the web of the exterior beams conforms to the chording while the cantilever projection supporting the parapet rail conforms to the curve of the carriageway. A shallow precast edging is incorporated and gives a visual continuity of line.

Sawmill Road Overpass :

The design developed for the Finnieston Overpass structure was repeated for the six-span structure of the Sawmill Road Overpass thereby achieving optimum economy by standardisation of construction elements and formwork.

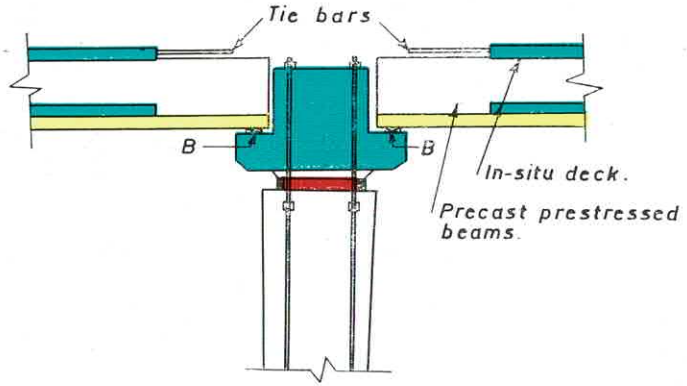
Finnieston Overpass and Bridge carrying Finnieston Street over future Central Low Level Railway



STAGE 1

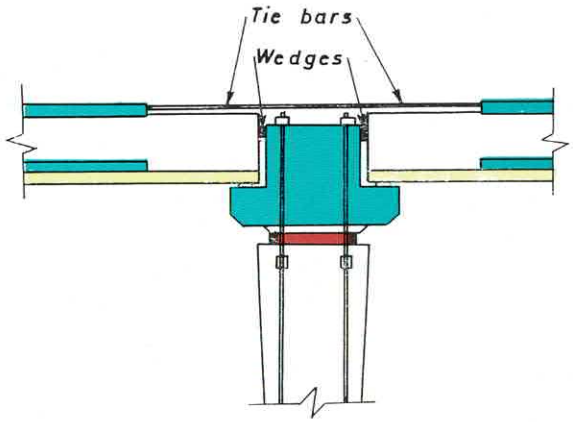
1. Capping beam constructed on locked bearing.
2. Capping beam prestressed against column through locked bearing by four Lee Macall bars coupled at A.

Prestress is asymmetric to cater for unbalanced loading of capping beam during erection of precast deck beams to any span and placing of in-situ deck concrete in adjacent spans.



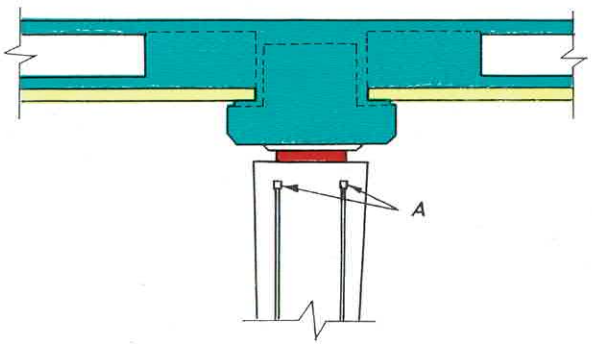
STAGE 2

1. Precast beams simply supported on temporary bearings at B.
2. In-situ deck concrete placed with tie bars in top slab.



STAGE 3

1. Lee Macall bars destressed.
2. Decks tied and wedged against capping beams to prevent movement during casting the joint.



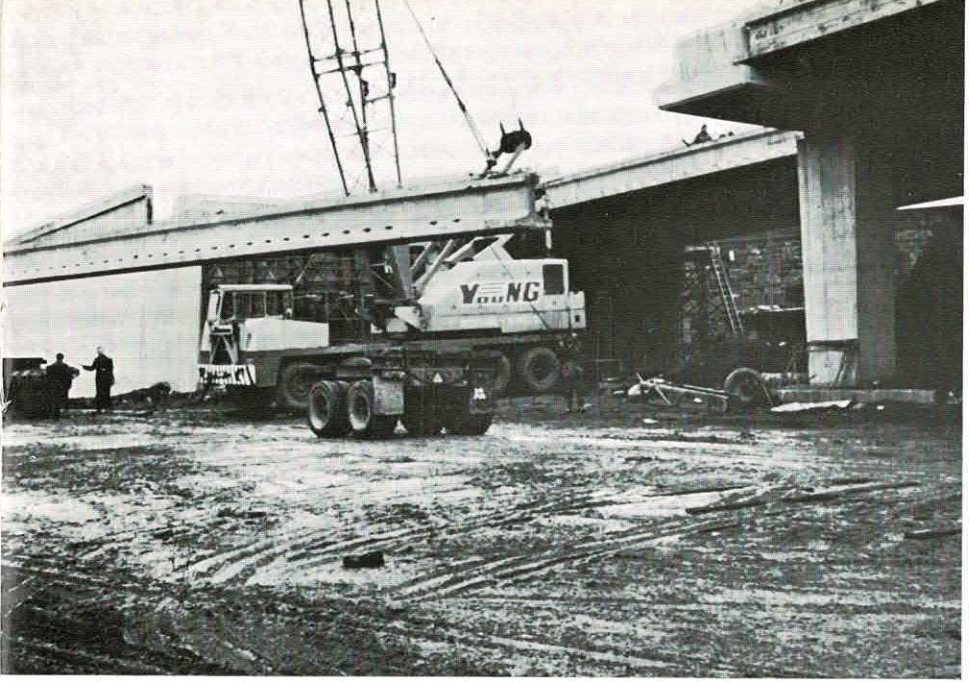
STAGE 4

1. Joint concreted.
2. Lee Macall bars uncoupled at A and removed.
3. Deck tied and wedged at next column bent.
4. Bearing released, allowing it to slide and rotate.

Procedure is repeated at each column bent working from ends of structure towards centre. When two halves of deck are joined, the bearings at centre column bent are released and the deck is fixed to the fixed-end abutment.

FIG. 2

OVERPASS — CONSTRUCTION SEQUENCE



Beam Erection for Finnieston Overpass

Sawmill Road Roundabout :

In addition to the construction of the main dual carriageway and associated slip roads some re-aligning of existing streets was necessary. At Sawmill Road a substantial roundabout was introduced to permit movement of interchanging and surface traffic and a new length of roadway was included West of the roundabout and South of the Expressway to give a continuity of route on Dumbarton Road which carries the principal bus services.

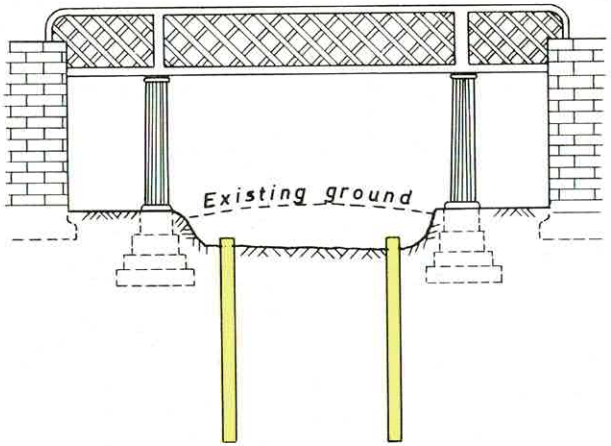
Beith Street Re-alignment :

In the vicinity of the Hayburn interchange there was a planning proposal arising from the Partick Comprehensive Development Plan for a new district distributor generally on the line of Beith Street. It was necessary to construct a length of this new road to serve Hayburn Street interchange and to provide a replacement for Castlebank Street which was severed by the Expressway.

Beith Street Underpass :

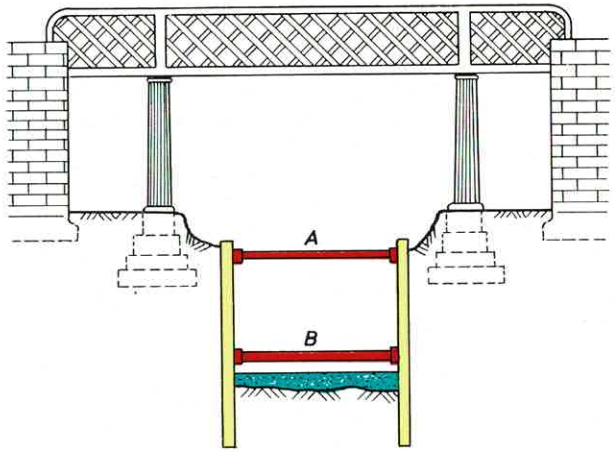
An underpass crossing of Beith Street was required on the line of Merkland Street to serve the present and greater future movement of pedestrians between the adjacent British Rail and Underground stations and the industrial areas South of the Expressway.

Construction of this underpass was complicated by the discovery that the footings of the bridge carrying the Blue Train urban service across Merkland Street were half as deep as the record drawings indicated. To enable excavation to be safely carried out, the Contractor proposed constructing temporary support walls of contiguous bored piles over the critical lengths adjacent to the bridge column footings. The Consultants believed that safety and cost would benefit if the Contractor's temporary works proposals were integrated into the permanent design. Discussion took place with the Contractor and led to a revision of the underpass design by extending the length of contiguous piled wall, reducing the distance between the parallel runs and incorporating them into the structure of the underpass.



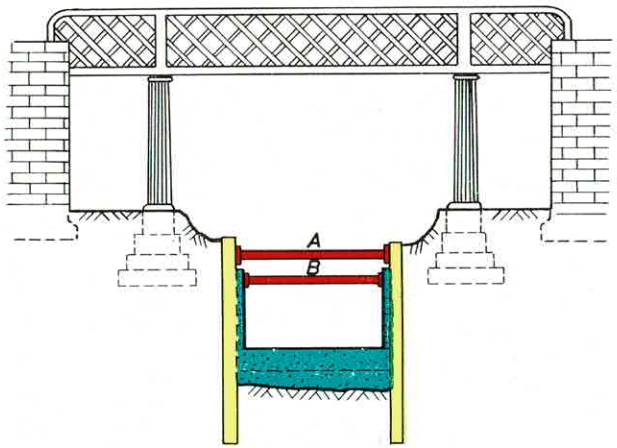
STAGE 1

1. Existing road surface lowered to increase headroom.
2. Contiguous bored piles sunk to form parallel walls.



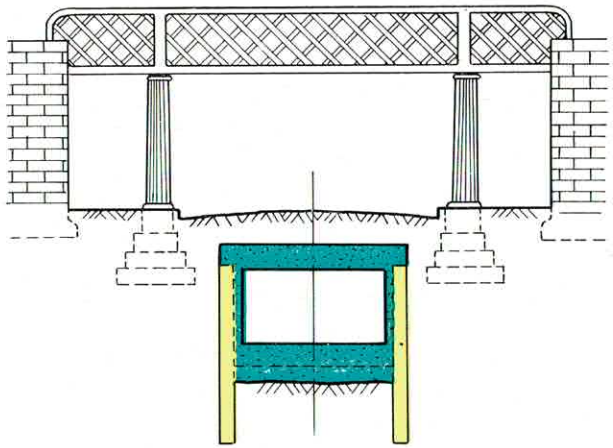
STAGE 2

1. Excavation commenced and frame A erected.
2. Excavation completed and frame B erected.
3. Unreinforced concrete cast to 1st stage of underpass base.



STAGE 3

1 Frame B removed.
2 Reinforced concrete cast to complete underpass base.
3 Concrete wall of underpass cast against piles.
4 Frame B re-erected against concrete surface.
5 Frame A removed after frame B erected.



STAGE 4

1 Top of piles cut down to expose reinforcement.
2 Roof slab cast integral with pile tops.
3 Frame B removed.
4 Backfill placed and surface reinstated.

CONSTRUCTION OF BEITH STREET UNDERPASS

FIG. 3

Excavation for Beith Street Underpass

The sequence of construction is diagrammatically represented in Fig. 3. It is estimated that some £20,000 was saved by carrying the work out in this way and that the hazard to the stability of the railway bridge was substantially lessened. Rail services were not interrupted during the construction period.

Merkland Street has been permanently closed to traffic north of Beith Street and it is believed that when the existing railway bridge is renewed by British Rail it will be shortened to a single span crossing Beith Street. To provide for this probable eventuality the underpass extends sufficiently far north and is strong enough to permit extension of the railway embankment across Merkland Street to a new abutment parallel to and north of Beith Street.

Land and properties, and Services

Acquisition of land and property and demolition of the latter was carried out by the Corporation at a cost in the order of £1·2m. Diversion of Public Utility services was arranged by Sir William Halcrow & Partners and cost around £230,000. Street lighting was carried out by the Corporation Lighting Department and road signing was under the direction of the Traffic Section of the City Engineer's Department.

Letting of Contract and Progress of Work

A Contract for construction of the Expressway was let in March 1971 in the sum of £3·59m for completion in three years. In the event the time taken to complete the works to commissioning stage has been only two years and one month ; this despite a shut down due to the 1972 building strike when six weeks of construction weather was lost.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Landscaping :

The aesthetic appeal of the roadway was carefully considered from the outset. An opportunity was clearly offered by the new works to improve the visual attractiveness of the route by landscaping all available areas marginal to the roadway. William Holford and Associates co-operated with the Consulting Engineers in successfully giving effect to that opportunity.

The Expressway has been constructed through an area of intense industrial development devoid of established landscape spaces with which to integrate the proposed new planting belts. The proximity of physical features such as railway embankments, industrial development and the River Clyde to the expressway alignment imposes a restraint with regard to the depth of landscaping that can be achieved within the expressway corridor.

The design principle in establishing belts of tree and shrub planting throughout the expressway is to provide a continuity in design between the building line of existing development with that of the expressway alignment by locating the plant material in such a manner as to highlight important features and views along the road, while in other situations endeavouring to screen and soften the visual impact of potential eyesore development. In areas adjacent to the expressway corridor and proposed for redevelopment such as at Partick and Queen's Dock, the landscape has been designed in detail to be integrated with further open space patterns within the proposed development, thereby ultimately establishing a greater depth of landscape between the expressway with the adjoining development.

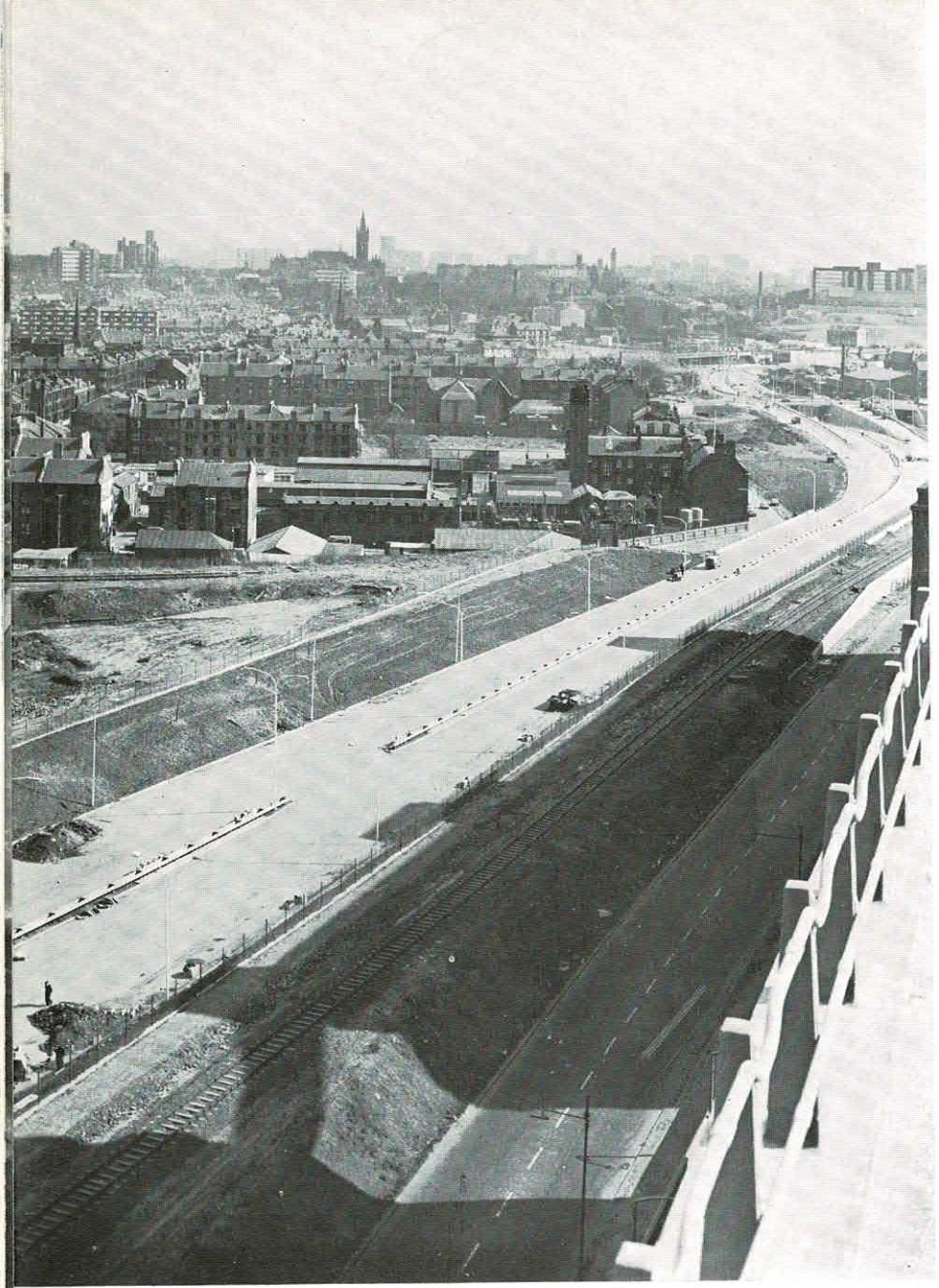
Hard landscape has been designed in areas unsuitable for soft landscape and in situations where a high intensity of usage is required. A variety of indigenous materials has been used in the design with a maximum re-use being made of granite setts.

The pedestrian system takes the form of linear footpaths which for the most part have been set back and segregated from the carriageways by a verge containing areas of dense shrub planting. At strategic points along the expressway, grade separated pedestrian underpasses and a footbridge are linked with the footpaths to form a safe and direct route for the public between their place of work and the public transport facilities. The underpasses at Finnieston Street, Ferry Road, Castlebank Street, Meadowbank Street and the pedestrian footbridge at Sandyford Street provide for the segregated movement across the Expressway while the underpasses at Hayburn Street and Beith Street complete the system which provides access to the Underground Station at Merkland Stteet and the bus and train services at Dumbarton Road. The underpass at Ferry Road will ultimately afford the pedestrian access to the proposed River Clyde and River Kelvin walkways.

The planting material proposed in the landscape areas is designed to provide an initial impact by the use of semi-mature trees placed at important visual locations along the line of the road. Continuity of landscape effect is achieved by the planting of new trees and shrubs of varying species and specific areas are designed to screen and direct the flow of pedestrian movement in addition to providing a variety of colour display to the pedestrian spaces.

Horticultural development and maintenance of the areas allocated for soft landscaping is and will be the responsibility of the Corporation Parks Department.

Sawmill Interchange



Looking towards Hayburn Interchange

Synopsis of Work Carried out :

3·5 km length of dual 7·3 m wide carriageway.
1·9 km length of 6 m wide slip road.
2·2 km length of existing street reconstruction.
2 Grade-separated intersections with Expressway elevated.
1 Grade-separated intersection with Expressway depressed.
1 At-grade roundabout junction.
415 m of dual carriageway viaduct structure.
1 Road Bridge redecked and widened over a railway in service.
1 Road Bridge over a future railway.
110 m length of reinforced concrete tunnel for a future railway.
80 m of existing tunnel reroofed over a railway in service.
1·3 km length of single track railway diversion.
8 Pedestrian Underpasses.
1 Pedestrian Footbridge

Synopsis of Principal Quantities :

119,000 cu m of excavation
121,000 cu m of filling
25,000 cu m of reinforced concrete
105 No. 1·2 m diameter bored cast *in situ* piles of average depth 18 m.
288 No. precast prestressed beams of M5 section.
243 No. precast prestressed beams of T2 section.
87,000 sq m flexible road construction.

Corporation Agents	J. Armour, C.Eng., F.I.C.E., F.I.Mun.E., F.R.T.P.I. *Master of Works and City Enginee* D. R. Colvin, F.A.P.L.E., *City Lighting Engineer.* S. A. J. Oldham, O.B.E., N.D.H., M.Inst.P.A., *Director of Parks.* G. A. Campbell, M.I.Mun.B.M., *General Manager, Building Department.*
Consulting Engineers	Sir William Halcrow & Partners
Landscape Architects	William Holford & Associates
Main Contractor	Balfour Beatty & Co. Ltd

Principal Sub-Contractors :

Bored Piling
London, Midland & Scottish Contractors Ltd.

Railway Trackwork
Eagre Limited

Road Surfacing
Val de Travers, Asphalte Ltd.

Bridge Waterproofing
Andrew Hutton & Son

Bridge Expansion Joints
P.S.C. Equipment Ltd.

Pedestrian footbridge
Butterley Engineering Co. Ltd.

Demolition of Railway Structures
Ferro Frank Limited

Steel Parapets & Handrails
Wm. Reid & Sons

Decorative Painting
James & M. Rough Ltd.

Boundary Fencing
A. M. Tweedie & Co. Ltd.

Road Markings
Prismo Universal Ltd.

Underpass & Underbridge Lighting
Balfour Kilpatrick Ltd.

Progress Photography
D. Wilson Laing

Aerial Photography
W. Ralston Ltd.

Principal Suppliers :

M5 Bridge Beams
Leonard Fairclough Limited

T2 Bridge Beams
Scottish Construction Co. Ltd.

Bridge Bearings
Solar Bridge Engineering Ltd.

Stone facings, road kerbs and slabs
John Fyffe Ltd.

Concrete aggregates and road sub-base
Kings & Co. Ltd.

Fill Material
W. H. Malcolm Limited

Boundary Fencing
Colorguard Ltd.

Guardrail
Armco Limited