



## TOWNHEAD INTERCHANGE Phase 2.

### Baird Street M8 East Off Ramp and Associated Works.

#### Consisting:

Earthworks for phase 2 & 3, plus Springburn Expressway link.

*Carriageway construction of* - Baird Street Off Ramp, linking to Springburn Rd and Baird St. Part of South Bound A803 below motorway to link into existing M8 west on ramp loop. Realign Springburn Rd A803 junction with Alexandra Parade to the East.

*Anchored RC Retaining Wall Support Works* - for future North & South A803 carriageway construction below M8.

*Surface Water Main Drainage works* - to suit the lower formation of new roadworks layout.

*Establish and set up at Glebe St north* - site construction compound with Resident Engineers Offices and New Materials Testing Laboratory to service existing and future contracts, Townhead Ph3, Springburn Expressway, plus other Roads Department testing requirements.

Resident Design Engineers:- Glasgow Roads Department, Strathclyde Roads.

## DESIGN CONSIDERATIONS OF THE WORKS.

In the late 1970's the M80 did not exist, most traffic heading north out of Glasgow, utilized Duke St, Alexandra Parade or Castle St, Royston Rd or Springburn Rd, towards Kirkintilloch and Stirling, a very slow process at peak times.

To ease traffic pressure through the Townhead M8 area, additional free flowing carriageway links were designed, to junction with the Motorway and future planned Expressway through Springburn. In addition, should the Inner Ring Road to the South advance at a later date, it would connect with the new layout being progressed at Townhead.

### Contract Programme.

Baird Street Off-Ramp works required to be completed within a 9 month timescale, as Phase 3 and Springburn Expressway works were anticipated to commence immediately on completion of Phase 2 operations.

An activity diagram network analysis programme was compiled to identify key construction operations which lay on the critical activity path, essential for contract completion within a designated 9 month timescale. This highlighted any time float available in important construction elements and available time bands and slots, in which other works could be undertaken, without influencing the contract end date.



## **Earthworks.**

The general existing ground level of the area at the time sloped lower to the west and south below the motorway, from the approximate level of Castle Street and Springburn Road.

To accommodate the new lower formation level for present and future north/south carriageway construction below the M8, considerable bulk earthworks excavation was required to achieve the new base level, with all material being removed off site to tip.

Due to heavy traffic flow through the Townhead area on a normal working day, moving the volume of material off site during the day would have been extremely disruptive to traffic movement and result in inefficient earth moving operations due to slow dump truck turn round time. Bulk excavation operations were therefore undertaken at night, plant working 7p.m.–7a.m. Monday to Friday, with the Townhead excavation plus Kirkintilloch tip sites floodlit. Working at night allowed a truck round trip through Springburn to Kirkintilloch, from excavator to tip, back to excavator, of about 40 minutes, which would have been impossible on the day shift. A fleet of 20 road going dump trucks, 5 excavators (one extra in case of breakdown, machine spare parts not readily available at night), 2 truck road sweeping brushes, plus emergency plant fitter (fix most breakdowns). All operated night shift, removing waste, soft clay and unsuitable material, below the M8 and principal excavation zone, to produce the new lower carriageway formations. The two road sweeping brushes worked continually at each end and along the route, to keep the public highway free from mud, normally by 6.30a.m. all roads were clean and ready to accept the new days 'rush hour' traffic.

## **Site Compound and Offices.**

As night earthworks operations advanced, all being 'critical' elements of the time programme, construction progressed during the day, establishing the site Office Compound, Materials Testing Lab and Resident Engineers Offices. At this time where possible, many of the existing gas, water, electricity and drainage service diversions were completed early, not to delay later works.

## **New 600mm Dia Surface Water Outfall at Glebe Street South, Constructed in Tunnel.**

To drain the lower level of the new carriageways, a surface water outfall pipe was required, to link at the south end of Glebe St, with a sewer manhole feeding water from the area to the old piped historic Molendinar Burn. The sewer was constructed in 'Heading' tunnel, being timbered roof and sides when excavated in clay, with blasting in rock strata, supports positioned where required; all between new and existing manhole positions, running under and to the east side of Glebe St, at a depth of 10-15m to achieve a suitable design pipe flow rate. In a heading tunnel, to lay a 600mm dia pipe, excavated material is removed producing a working space of approximately 1.2m x 1.2m in soft ground, with timbered supports in place (good old rail sleepers sides and roof), this results in an internal open working space of 1.1m high x 0.9m wide, rock is blasted to give similar approx' clearance.

Excavation is achieved with usually two miners at the face, one pneumatic digging as the



other pushes a loaded bogie skip on rails back to the shaft access manhole for removal, both miners would set the timbers and props. If it was a lengthy drive distance to push the skip back to the shaft, three miners would be involved to maintain the excavation face advancing. When the tunnel between manholes is complete, the pipe is set to level in the void space in an upstream direction, (faucets looking up/s to accept the next down/s pipe spigot) where the surrounding void is packed with a brick and concrete.

Day + Night shift was worked when tunneling, which maintained a secure advancing face, reducing any settlement influences, thereafter pipe laying and concrete fill of all surrounding void asp. Normal excavation rates per 10-12 hr shift, being 2-3m when advancing (2 lots of timber support sets) and twice progress when piping back, 4-6 m pipe set to level and concreted, Hard work! On completion of pipe runs, standard brick or concrete ring segmental access manholes were built at the junction locations.

### **Outfall Sewer Blasting and Vibration Monitoring.**

Solid rock strata existed in the lower half of the sewer run, it extended to the east below the Royal Infirmary and to the west, below the high flats in the Townhead, St Mungo Ave area. With blasting required to break and remove the rock, strict limits were set to minimize the intensity and frequency of any vibration which could cause damage to existing buildings, structures or property.

Strathclyde University, Engineering Department, assisted in vibration measurement monitoring at agreed fixed locations, when tunnel blasts were carried out.

Reducing vibration through the rock was achieved by shortening the forward direction of the tunnel face being broken with any one explosion, plus using staggered time delay detonators setting off different drill hole blasts milliseconds apart.

*Photographs show tunnel being driven, drilled rock face for blast and engineer checking level of pipe and concrete surround. I set out many a line & level for tunnels and pipes at the start of my career.*

Blasting the sewer tunnel in practice all went well, someone complained a picture fell off their wall on the 12<sup>th</sup> floor of one of the high flats, when the monitoring point below detected negligible movement. The main worry was the Royal Infirmary adjacent, as their computer unit at the time was housed in the nearest building. Measurements indicated all construction works were satisfactory, however the greatest vibration to their building was the corporation bus stopping and starting away from the bus stop outside their window. The involvement of the University resulted in a good few guided site tours and visitations by groups of their Engineering students; hopefully we inspired some of them. (Better than a sleep in the lecture room, free tea and biscuits were available).

### **Carriageway Construction.**

This phase of works consisted of establishing the new M8 East bound off ramp to the north, which looped round back to connect directly with Baird Street.

Also constructed, was part of the A83 Springburn Expressway south bound carriageway, below the motorway and east of the new anchored retaining wall, which allowed traffic



from Royston Rd and Springburn Rd to access the existing M8 West, circular loop on ramp. To accommodate future interchange contracts, Castle St/Springburn Rd Alexandria Parade junction, was relocated east to its final present position.

On completion of Bulk earthworks, with any unsuitable material removed, road formations were stabilized where required with imported engineering fill, red blaes, crushed brick or stone. Thereafter drainage, carriageway construction, kerb laying and blacktop surfacing progressed to completion within the programmed timescale.

### **Notable Incidents / Discrepancies Roadwork Construction.**

During excavation for road gully drainage on the north side of the Off Ramp, (marked red on sketch) the Forth & Clyde canal pipework was breached. It generally runs under and through the site keeping a continuity of water flow maintained west-east, from the Port Dundas Basin, linking through to the Alexandria Parade area. The working area was quickly flooded on a 'handy Sunday lunchtime', until water engineers were mobilized to close off various valves which halted the flow of water. After two days pumping all water was removed, with no damage resulting other than a broken canal pipe. On investigation it was discovered the pipe was higher than service drawings indicated and conflicted with the level of the carriageway edge kerb. All was resolved by lowering the canal pipe over a 10m length and incorporating a concrete thrust block at the change in gradient to resist the force of the water flowing down from Baird St above.

### **Concrete Anchored Retaining Wall.**

In preparation for the future Springburn Expressway route connections running under the M8, part of the supporting reinforced concrete retaining wall, between the north and south carriageways was constructed. The south bound route being at a higher level than north bound (to link with the M8 on ramp loop west), the wall was required to resist forces and maintain ground stability to the east. Photographs show the wall under construction with ground anchors being drilled and installed to achieve the design loading the structure was required to resist. When the anchors were complete and all concrete cured, test loading utilizing hydraulic jacks was applied to the anchor head, over a designated time period, to confirm satisfactory performance and designed 'factor of safety'.

The full length of the wall was completed in the future phase of Townhead contracts.

### **A Glimpse of the Past.**

At the northern limit of the works, where the new off ramp turned back towards Baird Street, past industrial use of the area was unearthed during excavations. The carriageway formations ran through the site of an old 19<sup>th</sup> century chemical works, which necessitated the removal of an extremely toxic soft unsuitable clay, containing arsenic, sulphur, lime plus a few other toxic chemicals.

Two 10cu.m. trucks were lined with plastic sealed membrane, allowing the excavated clay to be placed directly into the prepared vehicle body; when fully loaded, the plastic overlap was pulled closed sealing off the toxic material for transport. All was removed off site to a tip in



the Midlands, at the time no Scottish tip existed with a license to accept such waste. Immediately west of the chemical location, construction also encountered two Creosote/Tar Preservative dipping pits, assumed also form the same 19<sup>th</sup> century period. In addition to associated rubbish they also contained a few new 'preservation saturated' wooden railway sleepers and a perfect new wooden wagon wheel, which quickly vanished, likely to someone's back garden for ornamentation or a gate.

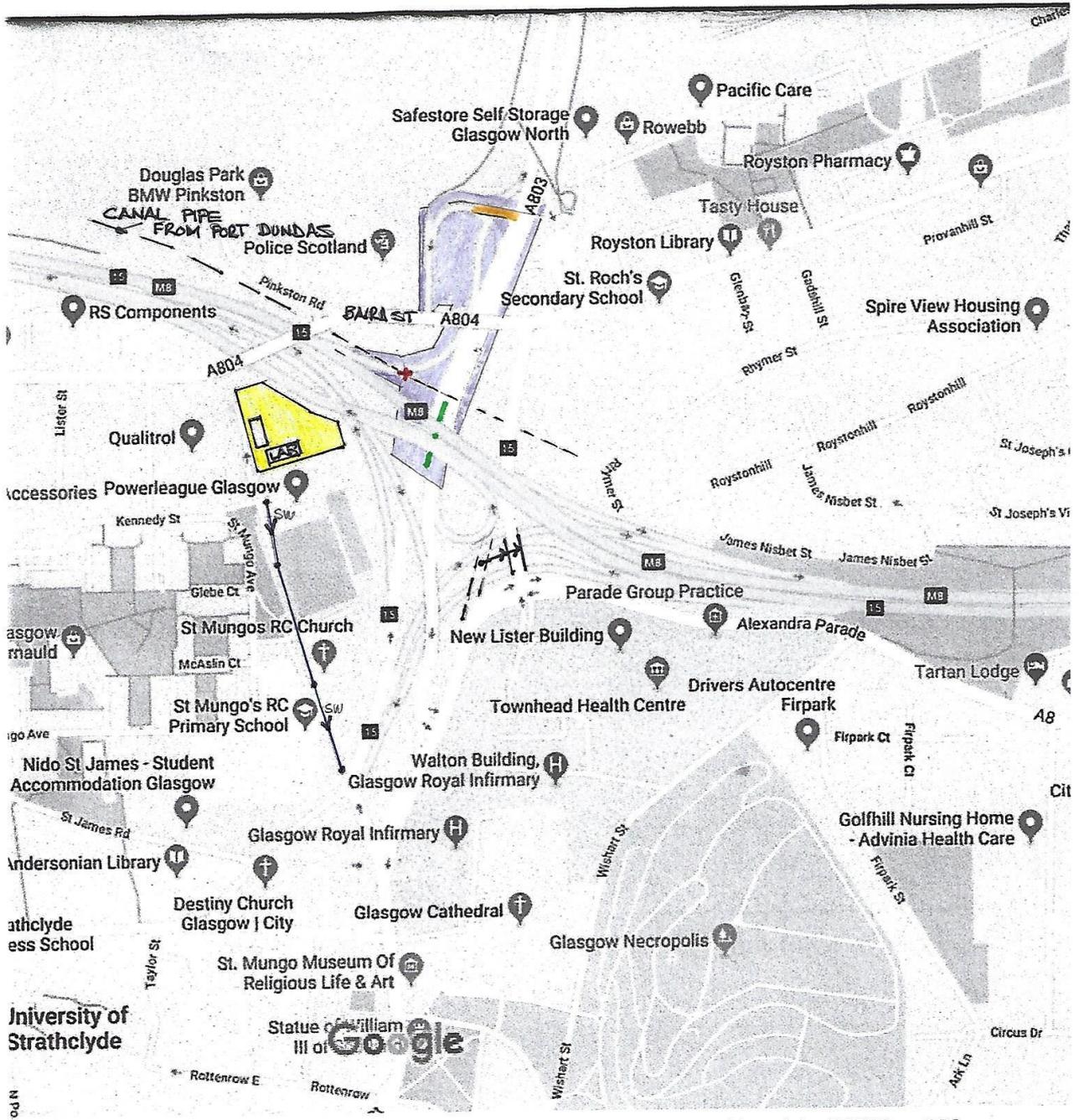
## **Summary.**

The Townhead contract was completed within the programmed timescale, allowing the next phase of construction contracts, to be progressed as scheduled by the City Roads Department.

The above brief description of Townhead Phase2, highlights noteworthy elements of the construction process, indicating methods and actions taken to achieve a satisfactory road infrastructure. All while keeping the existing traffic of the City flowing through the area with minimum disruption.

Ian McFarlane.      Ex Lilley Construction Ltd. (December 2019)

## **STAGE 2 DRAWING BELOW**



Map data ©2019 100 m

-  SITE OFFICES & LAB.
-  AREA OF EARTHWORKS MUCK REMOVAL.
-  GLEBE STREET SW SEWER OUTFALL TUNNEL.
-  CANAL PIPE BREACHED.
-  ANCHORED RETAINING WALL FOR FUTURE WORKS.
-  OLD CHEMICAL WORKS TOXIC WASTE
-  JUNCTION MOVED EAST.

NOTE:  
 POSITIONS ON THIS PLAN  
 APPROXIMATE TO ILLUSTRATE.