March 21 opening for Supertram

Sheffield's £240 million Supertram system entered service in March,

Opening of the first phase of Sheffield's South Yorkshire Supertram was due to take place on 21 March, with the commencement of public services on the initial 8km city centre Commercial Street-Meadowhall section. The southern section to Halfway is scheduled to be operational by the summer of 1994, and the entire 32km system is due to be commissioned during 1995.

Sheffield becomes the second UK city after Manchester to introduce a modern light rail system, but Supertram differs from its trans-Pennine Metrolink neighbour in several key respects. First, the system has a substantial amount of on-street running, some 16km of route sharing road space with other traffic. Just 3.2 route-km uses ex-British Rail alignments, the remaining 12.8km running on segregated tracks adjacent to roads. Second, the hilly terrain in and around Sheffield calls for gradients as steep as 10 per cent in places. This has had a major bearing on the design of vehicle for the line, as well as calling for substantial civil engineering work.

The £240 million scheme has been sponsored by the South Yorkshire Passenger Transport Executive (SYPTE), working through its wholly owned subsidiary South Yorkshire Supertram Limited (SYSL) under its Chief Executive John Davies. SYSL operates in two halves under a common board of management: SYSL 1 has undertaken development, building and commissioning the system, while SYSL 2 has a 30-year concession to operate Supertram. It is intended that SYSL 2 will in due course be privatised, although ownership of infrastructure and rolling stock will remain with the SYPTE. Currently, transfer to the private sector is expected to take place in late 1996 or early 1997.

Funding for Supertram has mostly come from central government and from credit approvals for local authorities, although there has been a limited amount provided by property devlopers.

Balfour Beatty Power Construction Ltd won the international competition to design and build the system's infrastructure, undertaking civil engineering, trackwork, power supplies and overhead contact system (OCS), signalling, SCADA system and maintenance facilities. The rolling stock contract was awarded to Siemens plc. SYSL directly hadled contracts for relocation of public utilities, road traffic signalling, and Supertram's ticketing system. Turner & Townsend Project Management Ltd coordinated the project on behalf of SYSL.

Supertram in service

SYSL plans an eventual weekday daytime service frequency of 6-7 minutes, depending on speeds through Sheffield city centre. Services will be operated from 0600-2400. Carryings of 7 million passengers are expected in the first full year of Supertram operation from March 1994. This figure is forecast to grow to an annual 20 million when the complete system is in operation.

Single fares are to be based on two zones, one local, the other system-wide. In addition, tariffs fixed by the SYPTE will apply to child fares and those for concession holders. SYPTE-sponsored Travelmaster multi-mode tickets will also be valid.

Vandal-proof ticket vending equipment and validators by Abberfield Technology are located at most stops. Some 200 off-system Wayfarer ticket vending machines have also been supplied to retail outlets. These will offer discounts for multi-ticket purchases. Revenue protection will be undertaken by uniformed customer service agents, with a penalty fine option for fare evasion.

Supertram infrastructure - key facts

Route length: 32km, mostly double track.
Track gauge: 1435mm.
Track types: BS flat-bottom section 80A duo-block type for ballasted track, wooden sleepers for curves and points; 35G-TF grooved rail (French standard NF F52 523) for on-street paved sections; rail joints generally continuously welded. Trackwork by Edgar Allen, Pandrol railclips, Hanning & Kahl point motors, Edilon elastomeric grout.
Maximum gradient: 10 per cent.
Overhead supply voltage: 750V dc from 12 600kW substations receiving 11kV ac ring main input. Some OCS single-mast, some headspan, all cross-connected for regenerative braking.
Signalling: generally line-of-sight, with priority signalling by Siemens for Supertram at road intersections, and point signalling by Henry Williams.
Stations: 45, each with shelters, seats, lighting and ticket vending/validation equipment. Platform height is 420mm. Station furniture by Abacus, on-station ticketing equipment by Abberfield Technology. 200 off-system ticket-issuing machines supplied by Wayfarer. Magnetic strip tickets by Henry Booth.
Major structures: 64, including major viaducts at Norfolk Park and Sheffield Parkway, nine bridges, and a road underpass.
Depot: Located on 2.6-hectare site at Nunnery, with stabling provision for 25 Supertram vehicles. Facilities includes washing plant, Hegenscheidt wheel lathe, lifting equipment. Also houses operations and driver control centre, and infrastructure maintenance base. Provision for addition of paint

Supertram trial running has been undertaken since January, testing vehicles and systems, and familiarising staff

Supertram LRVs

Rolling stock for the Sheffield scheme has been supplied by Siemens and built by subsidiary Duewag in Düsseldorf. Weighing some 50 tonnes, and nearly 35m long, the 25 Supertrams now under delivery are among the largest LRVs built - only the same manufacturer's vehicles for Karlsruhe and Stuttgart are larger.

Two demanding factors dictated the choice of such a large LRV: the need to provide high capacity without running at service frequencies liable to disrupt other road traffic; and a requirement for a vehicle adapted to the 10 per cent gradients, 25m radius curves and 100m vertical curves which would be found on the Supertram system.

To meet these requirements, a three-section, double-articulated, bi-directional design was selected, providing accommodation for 88 seated and 155 standing passengers. Low floor (420mm above rail) entrances matching platform heights are provided in the two outer vehicle sections. This ramps up to 480mm, while steps lead up to the centre section, which is 880mm above rail, and is primarily an all-seater section which SYSL hopes will be used by longer distance passengers. Provision is made for mobility-impaired passengers, luggage and pushchairs, and some 40 per cent of the floorspace is low-level.

Under-seat heating and pressure ventilation is provided, and tinted windows are fitted. LCD displays provide next-stop information, and a 14-speaker public address system with two-way communication capability is installed.

Bodyshell is of welded Corten-B steel construction, with an aluminium honeycomb ceiling. Most of the traction control equipment is roof-mounted, but some auxiliary equipment is housed beneath the high-floor centre section. Floors are of wood, bonded to

the underframe and coated with slip-resistant rubber flooring.

To meet the demanding traction requirements of the SYSL system, Supertram runs on four bogies, all powered, each with a single fully-suspended, longitudinally-mounted traction motor. These are fed by proven Siemens dc chopper control equipment with GTO semiconductors. Combined one-hour rating is 1108kW. Wheels have resilient rubber inserts, and outer bogies are equipped with wheel flange lubrication. The body is supported on the bogies by slewing rings, with a secondary suspension system of the air-bag type.

Interior view of Supertram, taken from the vehicle's centre section

Service brake is blended regenerative and rheostatic, with spring-applied pneumatic brake as standby. Emergency and parking braking, and track brakes are also provided. (See box story.)

Diagnostics play a key role in the satisfactory functioning of each Supertram, with a Central Control Unit monitoring all main vehicle systems and displaying any fault in the driver's cab.

By the end of February, 15 examples of the eventual fleet of 25 vehicles had been delivered to Sheffield.

Stopping Supertram

The demanding operating environment in which South Yorkshire Supertram is to operate calls for effective fail-safe braking systems. While the service brake on the new vehicles is blended regenerative/rheostatic, Knorr-Bremse has in addition supplied friction brakes, track brakes, air supply and auxiliary equipment for the 25 vehicles.

Friction braking is microprocessor-controlled and pneumatically operated, providing wheelslide control and load corrected brake force during service and emergency braking. It is designed as an absolutely failsafe system in event of electric braking failure. Brake cylinders are of the spring-actuated type, with loss of pressure resulting in brake application. One brake disc is provided on each axle. The emergency brake is actuated by a magnet valve controlled directly from the safety loop by hard wire. Redundantly, Knorr electronics feed emergency brake pressure in case of magnet valve failure. Sanding units are provided in front of the first and fifth axle in each running direction.

Compressed air is provided by a sophisticated, quiet-running screw type compressor, the air then being dried in a dual-chamber air drying unit to guarantee against water ingress.

Modular microprocessor control electronics interface directly with the LRV train lines and propulsion control system, and include diagnostics, status display and fault anunciation.

Each Supertram is also equipped with a third independent braking system in the shape of Knorr-Bremse track brakes, with eight magnets per car. The same company has also supplied its air suspension control system to ensure the carbody is at a constant height under all load conditions.

Fax: +49 89 35 47-2818