about Metro Monorail

# History of the Monorail

The Metro Monorail came into being to move millions of visitors and Sydneysiders in and out of the 50-hectare Darling Harbour site, while linking up with existing public transport – trains, ferries and buses – at key locations in the central business district.

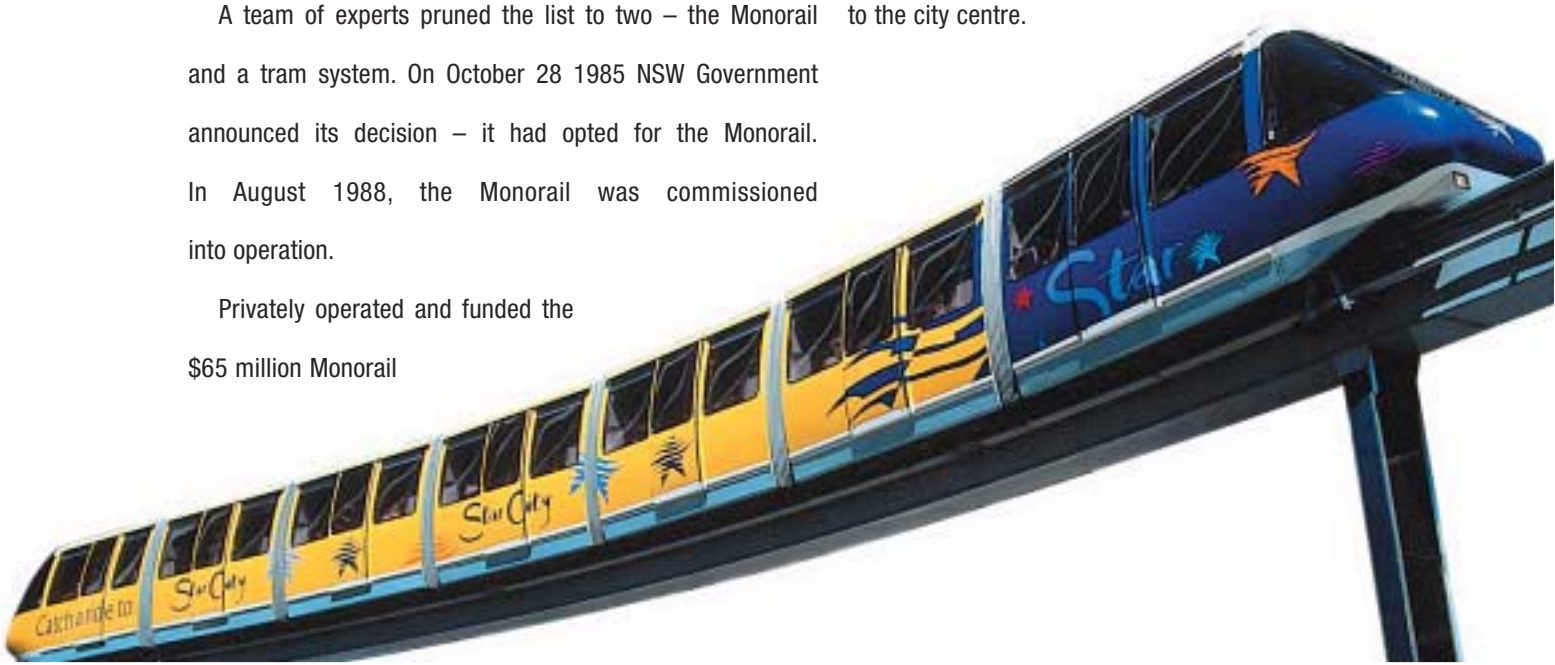
In 1984 the Darling Harbour Authority called for proposals. It received over 20 expressions of interest, among them several Monorail schemes, some operating on a track, others suspended.

A team of experts pruned the list to two – the Monorail and a tram system. On October 28 1985 NSW Government announced its decision – it had opted for the Monorail. In August 1988, the Monorail was commissioned into operation.

Privately operated and funded the $65 million Monorail gives Sydneysiders and visitors a swift and scenic ride to the numerous attractions of Darling Harbour and moves them through the retail heart of the city in style and comfort.

It is the ideal mode of transport to access the shops and restaurants of Harbourside, Australian National Maritime Museum, Powerhouse Museum, Queen Victoria Building, Entertainment Centre, Chinatown and Pitt St Mall.

For residents of the Pyrmont and Ultimo precinct, the Monorail provides a convenient transport link to the city centre.



# System of Operations

**As trains are semi-automatic, the decisions regulating the normal safe operation of each train are carried out by micro-processor based control system in the front car of each train.**

Unlike remote controlled craft, which are directly instructed by an operator, the monorail trains receive system status data which permits them to proceed as automatically programmed if safe operating conditions exist.

The trains also have control panels which allow manual guidance of the trains when placing into operation or during service maintenance.

Under semi automatic control, the fail safe needs of the Monorail system require that every level of information collection, processing and communication is either duplicated or simultaneously checked by separate systems to ensure that safety is never compromised.

At the central control room two main computers are linked in a master/standby relationship. Either machine may be started as master and while operating, the standby stays in a back-up mode, its data base being regularly replenished by the master to ensure that it remains conversant with system conditions and is able to assume full command within seconds, should any failure occur in the master computer.

*The Monorail central control tower located in Pyrmont.*

Each Monorail unit is able to carry out its own automatic control of speed, acceleration and deceleration and can also monitor and control its safety systems.

The equipment fitted consists of a series of computers and an autopilot controller. The two systems work together providing checks on each other and are fitted with standby systems in the event of failure of the working system.

The computer system comprises a main unit built into the nose cone which determines the Monorail position by means of pulse counters. The system resets to zero at every station and is supplied with power from onboard batteries.

Information on position is relayed to the central control room which in turn relays this information to other units on the loop so that each Monorail is aware of its relative position.

Further control computers are fitted to each carriage in the Monorail unit to monitor and control drive motors, doors, lights and other systems. The main computer is preprogrammed with complete information on the position/distance/speed relationships of the loop.

The autopilot controller uses a control rail cut at intervals and joined by diodes to determine the Monorail position by measuring the number of diode voltage drops between it and the unit in front.

The autopilot can then regulate speed accordingly. Diode failure can be detected by the autopilot and in the event of a short circuit diode failures are detected by a station–to–station check circuit.

Speed is monitored from a pulse generator fitted on the non-drive bogies at the front and rear of the Monorail. Information is relayed back to the central control room. The autopilot will override the computer speed control if reference signals from the nondrive bogies indicate speed beyond tolerance.

# Construction and Design of a Pollution Free System.

Construction of the Monorail generated 500 jobs, with about 200 permanent employees needed to fill operations, maintenance and clerical positions.

The comfort of passengers has dictated the use of wide doorways and large tinted anti-glare windows. All the stations have elevator access, allowing those disabled in wheelchairs unimpeded access to the system. The train floor level is self adjusting according to load by means of an automatic suspension system allowing the train floor to always align with the platform level.

Quiet, pollution free electric motors propel the Monorail along the continuously welded track and, in order to further reduce noise, rubber wheels have been used for the drive wheels of the trains. The track has been fitted with expansion joints specially designed with sliding steel components to maintain a continuous smooth running surface.

# The Crossing of Pyrmont Bridge

**One of the unique features of Sydney's Metro Monorail system is that the track passes over the historic Pyrmont Bridge, the track structure utilising the unique span feature of the bridge which has been restored to its 19th Century splendor as part of the Darling Harbour redevelopment.**

***THEN***... *Pyrmont bridge in the early 1900's.*
***NOW***... *Pyrmont bridge today with the Metro Monorail system.*

The central pivoting section of the bridge is still operable to allow the passage of vessels into and out of the section of Darling Harbour south of the bridge. For the passage of small vessels up to 15m mast height, the monorail track remains unbroken by the provision of a specially designed pivot column located in the centre of the bridge swing span.

For the passage of larger vessels the monorail track swings with the bridge swing span, thus temporarily interrupting the service.

An interlocking system is provided within the control system which closes and stops all monorails into stations, isolating power from the monorail track and unlocking the swinging section of the monorail beam.

# The Company

Metro Monorail is owned by Metro Transport Sydney. Metro Transport Sydney is a privately owned Australian company, with three main shareholders, Utilities Trust of Australia and Australian Infrastructure Fund managed by Hastings and Colonial First State Investments. The Monorail is operated by Connex.

# Maintenance and Storage

This facility is situated in Pyrmont between Convention and Haymarket monorail stations.

A traverser system is fitted to move monorails in and out of the main circuit, the traverser being able to align with five storage tracks, a monorail washing track, and tracks for maintenance and inspection.

Full work shops and the central control room are located in this complex.

The maintenance track is specially designed to allow the monorail to be run up and supported on the upthrust rollers, so allowing access to the drive bogies for maintenance purposes.

The traverser is in fact, a double traverser: the working traverser described above delivers and retrieves the monorails from storage, and the through traverser maintains the main track allowing uninterrupted service.

Interlocking is provided to prevent a second monorail from entering the section incorporating the traverser until the traverser sequence is complete and all safety checks are satisfied.

# Technical Details

## and all that stuff...

### ROLLING STOCK

| | |
|---|---|
| Number of cars per vehicle | 7 |
| Total length of vehicle | 32.12 metres |
| Overall width of vehicle | 2.06 metres |
| Overall height of vehicle | 2.6 metres |
| Height of door entrance | 2 metres |
| Length of front and end carriage | 5.55 metres |
| Length of middle carriages | 4.12 metres |
| Vehicle maximum capacity | 170 passengers approx. |
| Maximum seated per vehicle | 56 passengers |
| Maximum monorail speed | 9.2 metres per second (33 kph) |
| Number of drive units per monorail | 6 (located between carriages) |
| Number of bogies | Total 8 (6 drive bogies and 2 lazy bogies) Each bogie is equipped with 2 riding wheels, 4 side thrust and 4 up-thrust wheels. The riding wheels are special 750mm diameter heavy duty pneumatic tyres fitted with patented flat tyre protection rim. |
| On board security/communication | Full audio communication from each carriage to control room |

### SYSTEM OPERATIONS

| | |
|---|---|
| Number of monorails | 6 |
| Maximum number of circuits per hour | 4 |
| Average headway time (6 trains in service) | 1.98 minutes |
| Number of stations | 8 |
| Platform length | 27 metres |

### TRACK

| | |
|---|---|
| Rail type | Box girder fabricated steel |
| Rail size | 832mm x 700mm (height x width) 940mm top flange |
| Spans | 30m on straights (nominal) |
| Support columns | 690 x 125 UB (typical) rolled steel (i.e. 690mm flange to flange, 250mm wide, Universal Beam section weighing 125kg/m) |
| Minimum radious of curves | 20m (reduced speed 5m/sec) |
| Maximum gradients | 4.5% up 6.5% down |

### MAINTENANCE

| | |
|---|---|
| Facilities | Include vehicle storage washing and cleaning, full maintenance facilties (including pit) and control room. |
| Number of traversers | 1 with 2 beams to install and remove monorails from service. |

### POWER

| | |
|---|---|
| Power supply | 525 V AC 3 wire/50 Hertz |
| Number of feeding units | 8 |
| Number of conductor rails | 2 + 1 earth using up-thrust collectors. |


**For any further enquires please contact us via:**

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