Urban Transit System - Introduction

Urban Transit System/Link as Natural MTR Extensions - Advantages

- Provide fully integrated feeder services and convenient interchange to the railway mainlines.
- Provide MTR network coverage to outlying areas with only moderate public transport demand.
- Integrated fare structure for interchange with MTR.
- Flexible in route planning (both horizontal and vertical).
- Effectively utilize the space above road and penetrate into developments.

Urban Transit System - Introduction

Urban Transit System/Link as Natural MTR Extensions - Advantages (Con't)

- Require relatively little road space and only moderate disruption to the public during construction.
- More viable than heavy rail (low construction costs and easy maintenance).
- Environmentally friendly.
- Significant contribution to Government public transport policy objectives.

Urban Transit System

Generic Description and Application

- (Heavy) rail-based urban transportation system such as MTR requires significant investment of initial capital costs for construction/procurement and notable long term costs for operation and maintenance.

- Other forms of (low to medium capacity) Urban Transit System are already in operation or being gradually developed overseas such as Japan and various European cities, serving moderate demand or acting as feeder links to the main railway lines.

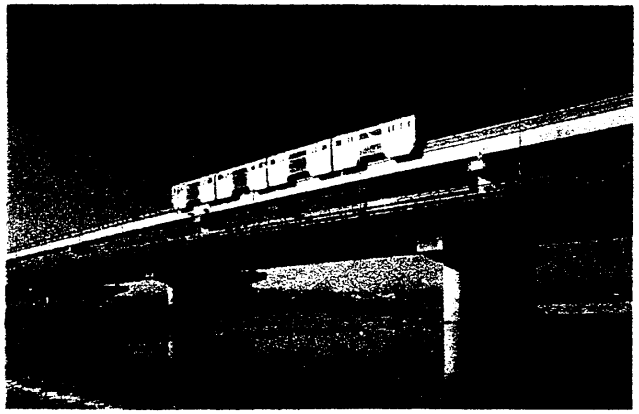
- All these transit systems are electrically powered, relatively economical and also bear the advantage of bringing quantifiable improvements to the local air quality.

Urban Transit System

Generic Description and Application (Con't)

- Proven application of grade-separated Urban Transit Systems worldwide (excluding heavy rail Metro) may be classified into the following categories.

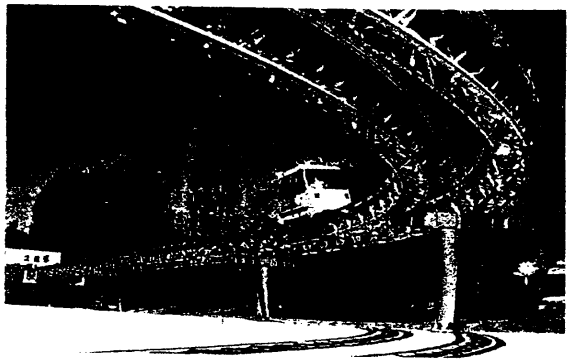
System Peak Demand (pax/hr)	Suitable System(s)
High (>20,000)	Monorail (up to 30,000 pph)
Medium (8,000 - 20,000)	Monorail
	AGT (rubber type)
Low (<8,000)	Cable-hauled Transit System
	Travelator on footbridge
	Hillside Escalator



Monorail

U T S

Automated Guideway Transit (AGT)



Cableliner

Urban Transit System

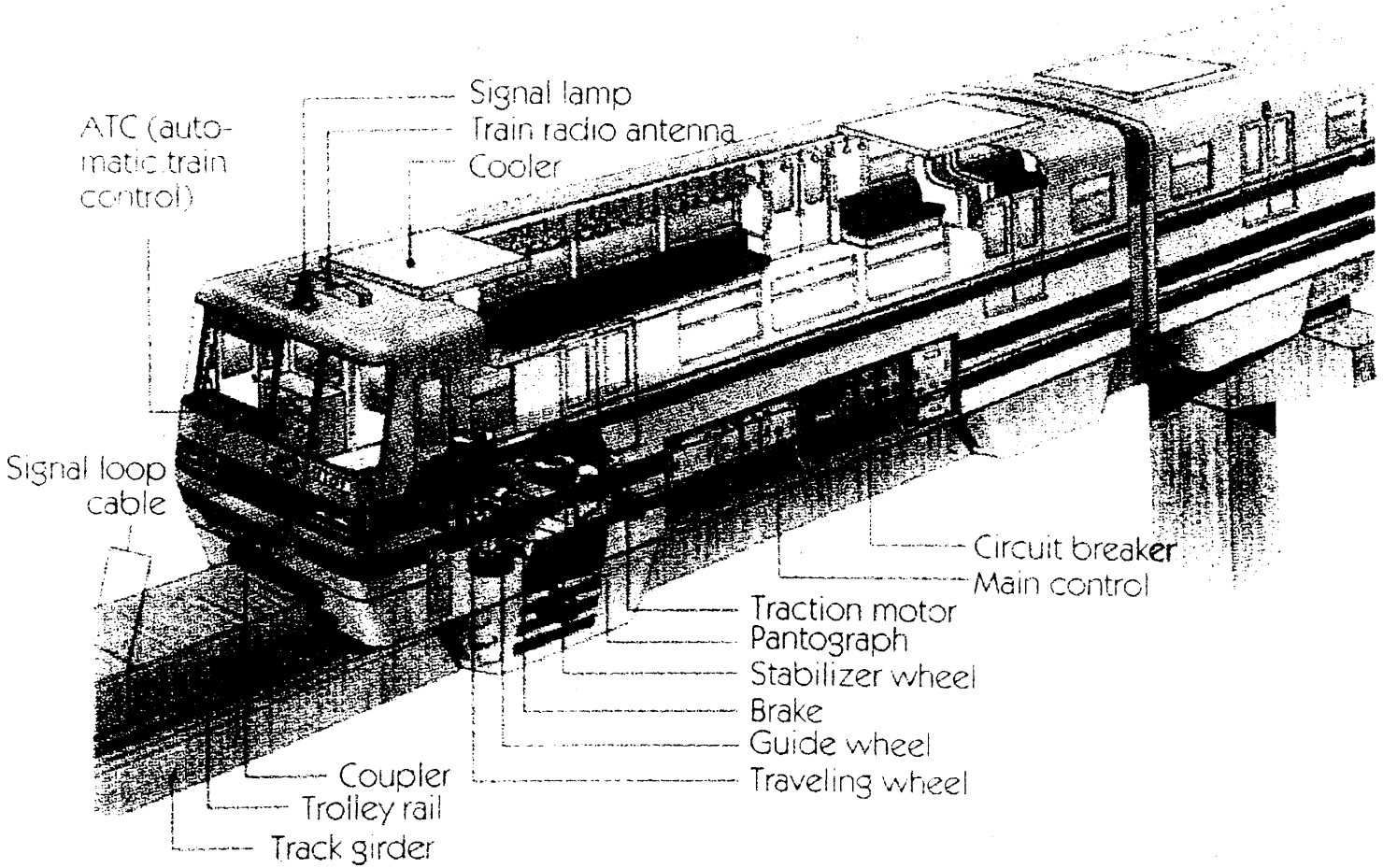
Monorail - Characteristics

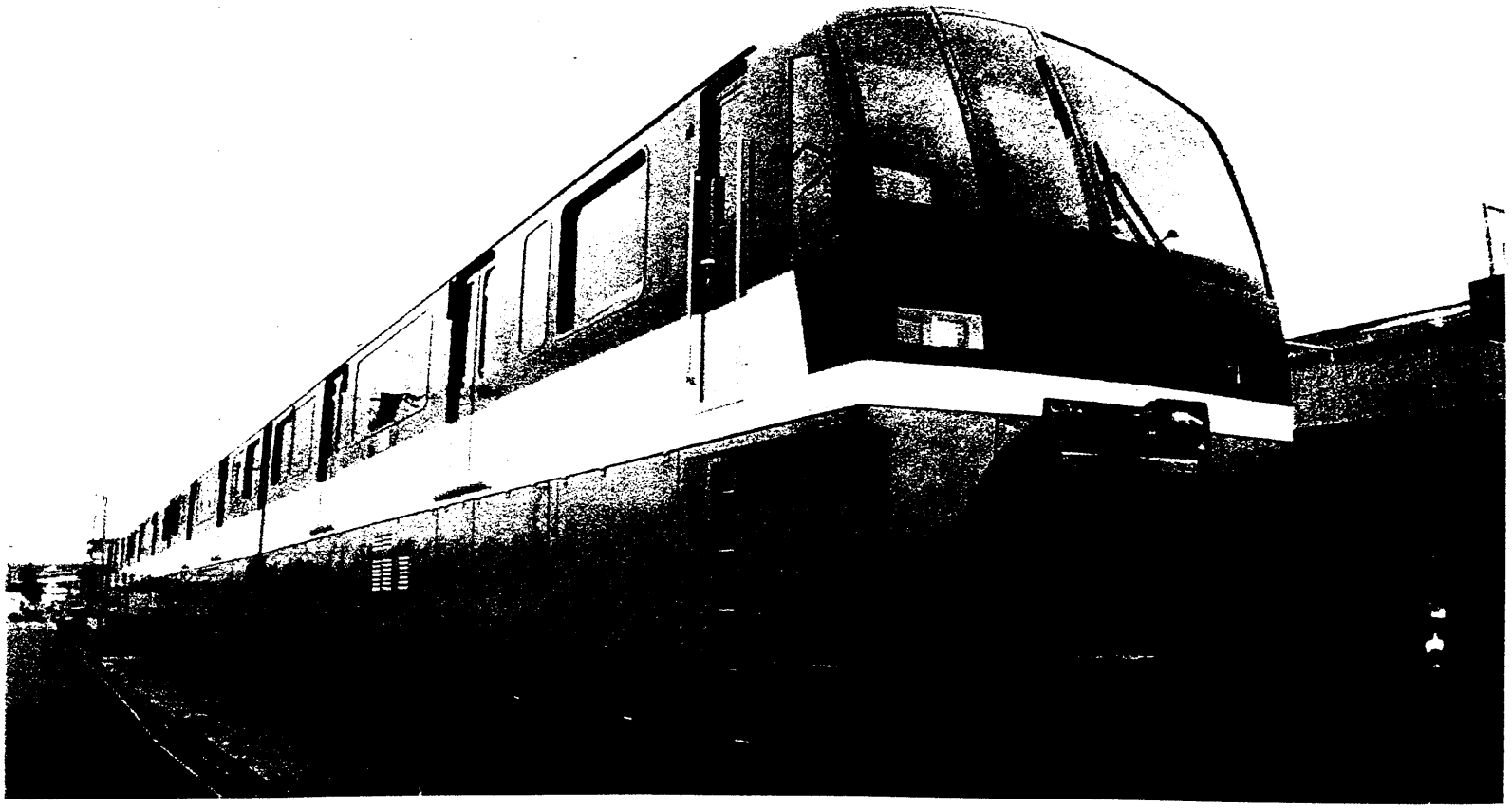
- Normally straddle type, rubber tyres on narrow concrete/steel guideways (i.e. I-beams of 0.8m wide x 1.6m deep) supported on concrete/steel columns. Visually more acceptable than heavy rail viaducts and bridges.

- Monorail systems are fully automatic (ie. driverless) with ATO/ATP. Trains on 2-car to 8-car formation and self propelled by electric motors using DC traction power at 1500V.

- Typical system capacity ranges from 8,000 pphpd to 30,000 pphpd. About 190 pax per car.

Straddle-Type Monorail

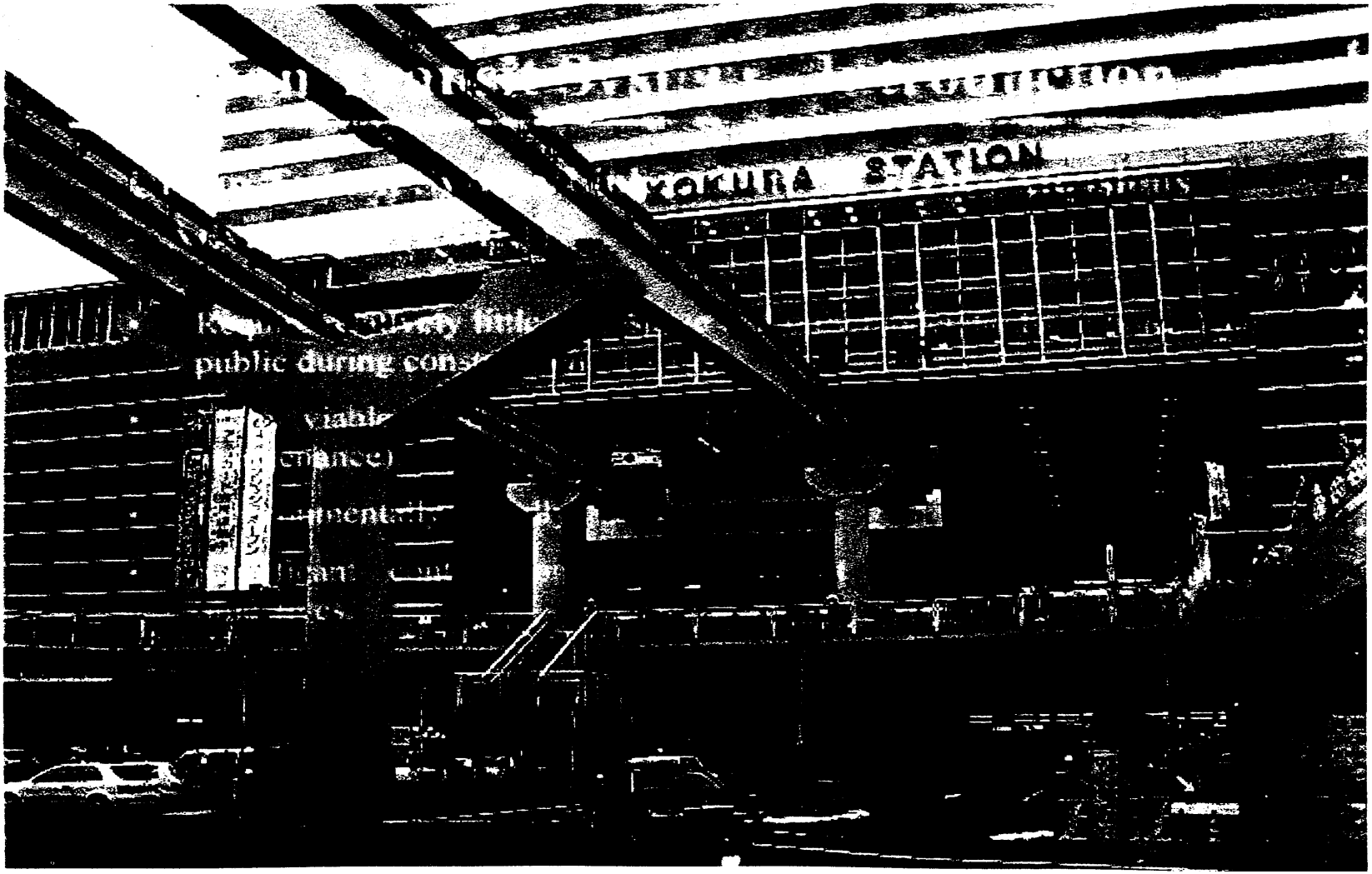


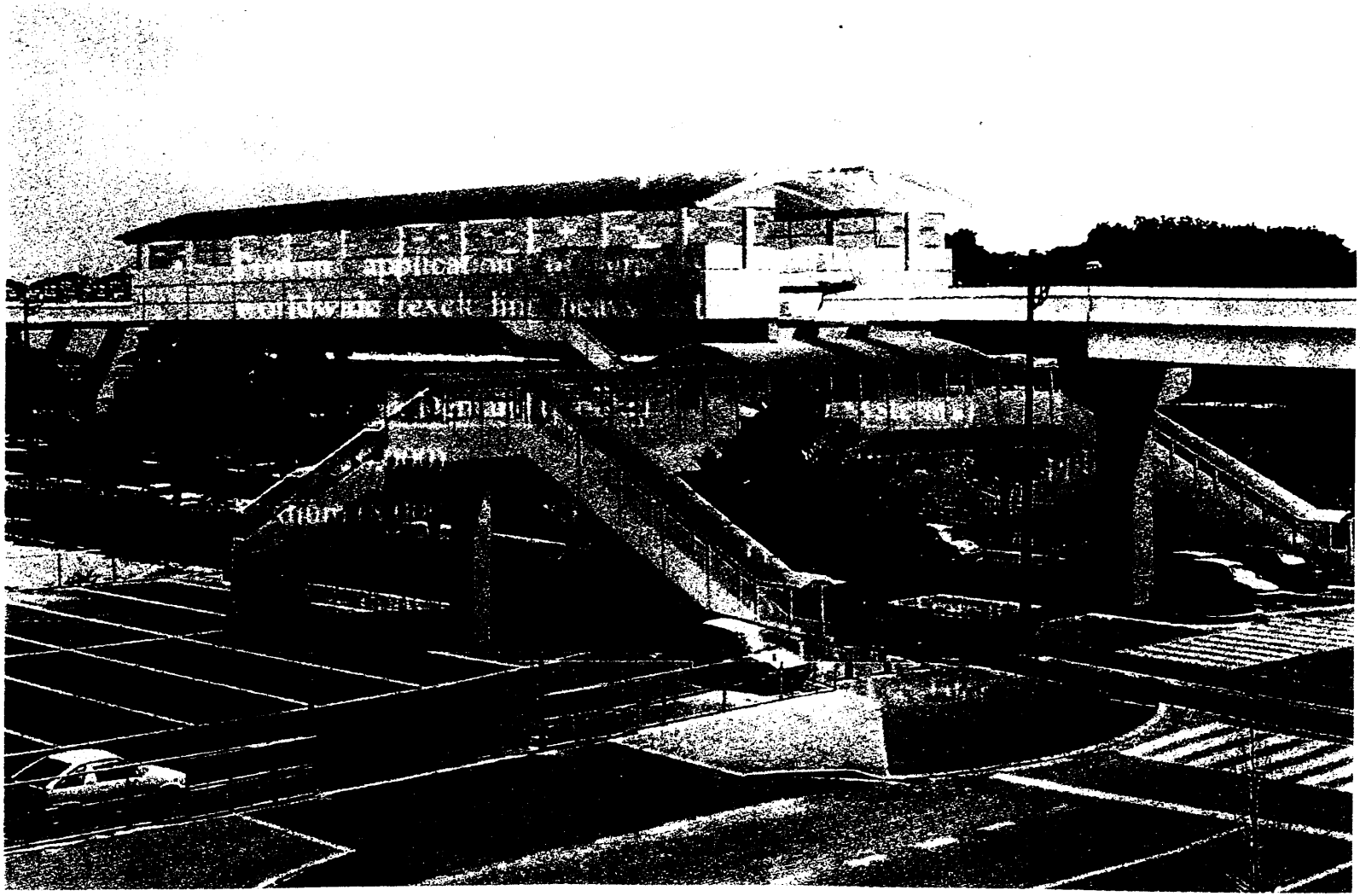


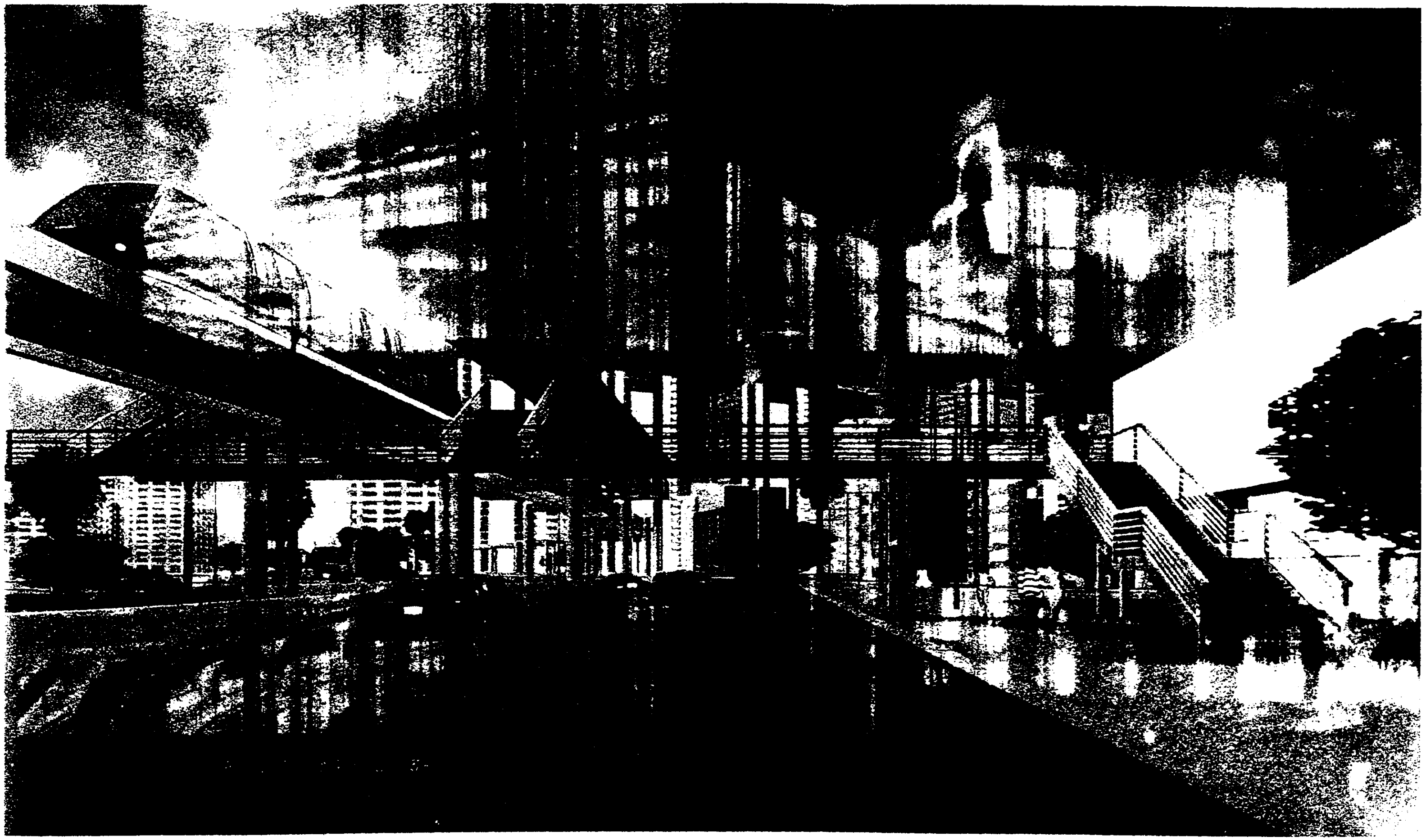
Urban Transit System

Monorail - Characteristics (Con't)

- Stations - normally elevated with waist height platform screen gates. Lesser amount of E&M plant rooms and facilities as compared with heavy rail stations.
- Requirement for dedicated maintenance and stabling depot to be located at-grade.
- Ability to fully integrate with public walkway and commercial complex Japanese experience.
- Approx. capital cost: $400M/km (for 20,000 pph capacity, excluding stations)
- Cost for a typical monorail station (elevated, 70m in length): $230M


KOKURA STATION





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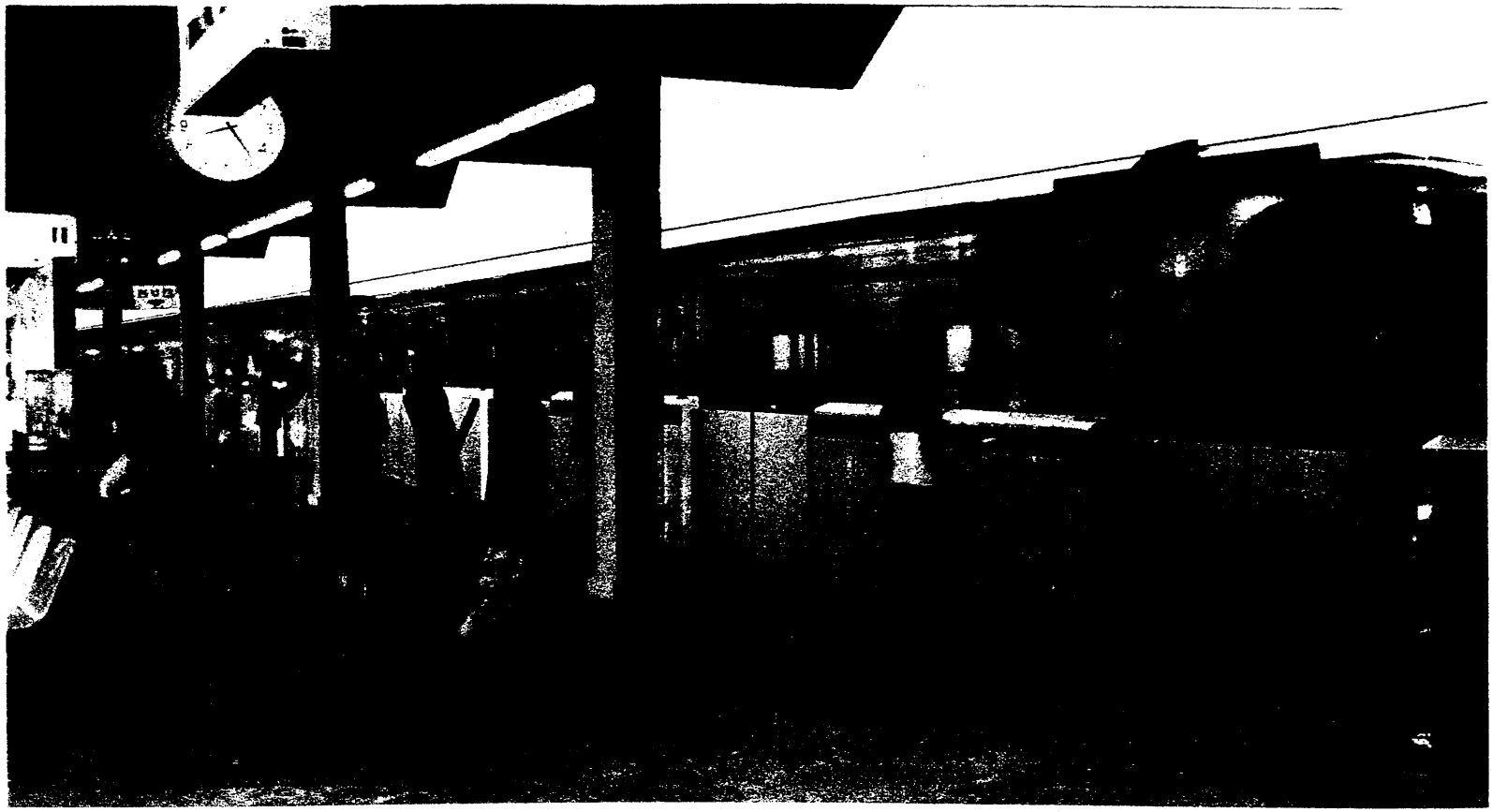

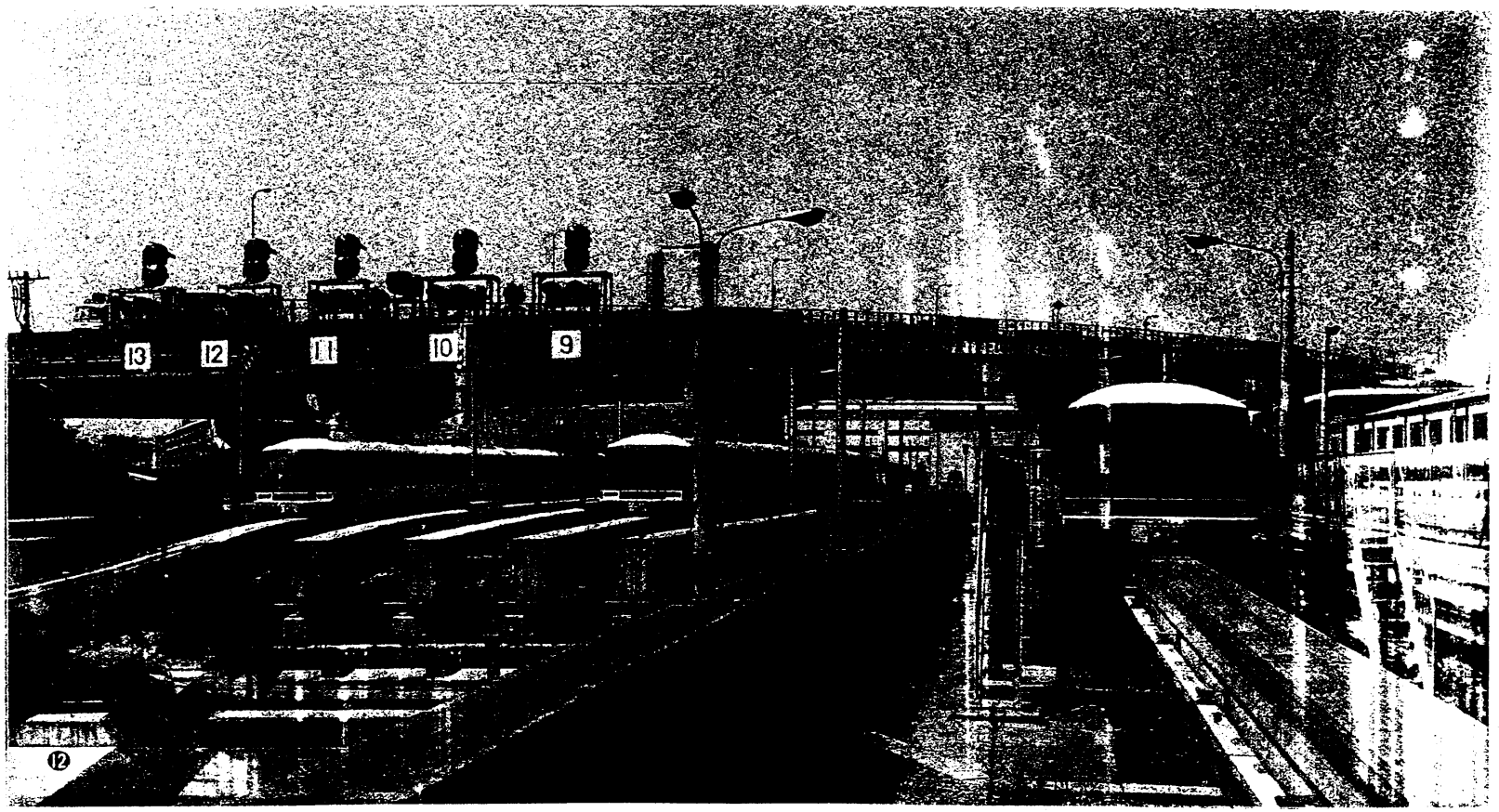
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Urban Transit System

Comparison of Key Technical Features

Item	Monorail	MTR
Maximum Speed **(Average)**	80 km/hr **(36)**	80 km/hr **(40)**
Max. Track Gradient	5%	4%
Min. Curve Radius	70m	300m
Overhead Structure (Single Track)	1.6m(deep)× 0.8m(wide) Concrete Guideway (I-Beam)	1.5m(deep)× 4.5m(wide) Box Girder Viaduct
Noise Level	70 dBA(normal speed) 65 dBA(reduced speed)	90 dBA(normal speed) 85 dBA(reduced speed)

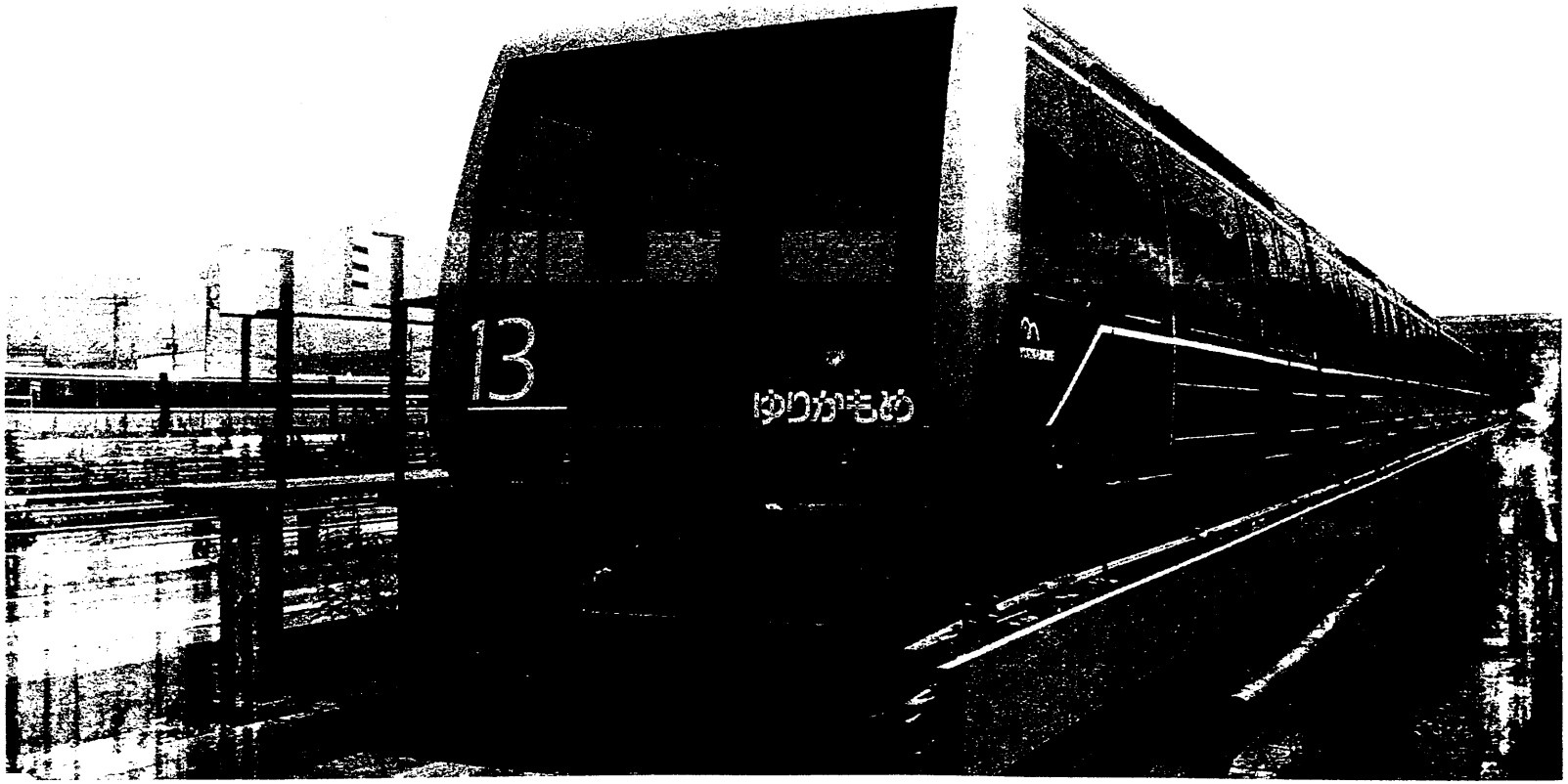
Urban Transit System

Automated Guideway Transit (AGT) - Characteristics

- AGT is another guideway transit system in which rubber tyre cars travel on special concrete track supported on viaduct structures. AGT trains can accommodate up to 6 cars.

- Proven experience in Japan for fully automatic operation, with ATO/ATP. Traction power supply using 600Vdc 3rd rail. Stainless steel car body with side-guided or central-guided steering system.

- A capacity of 20,000 pph is quoted as the upper limit of the Japanese AGT systems now in operation. Capacity per car about 125 pax.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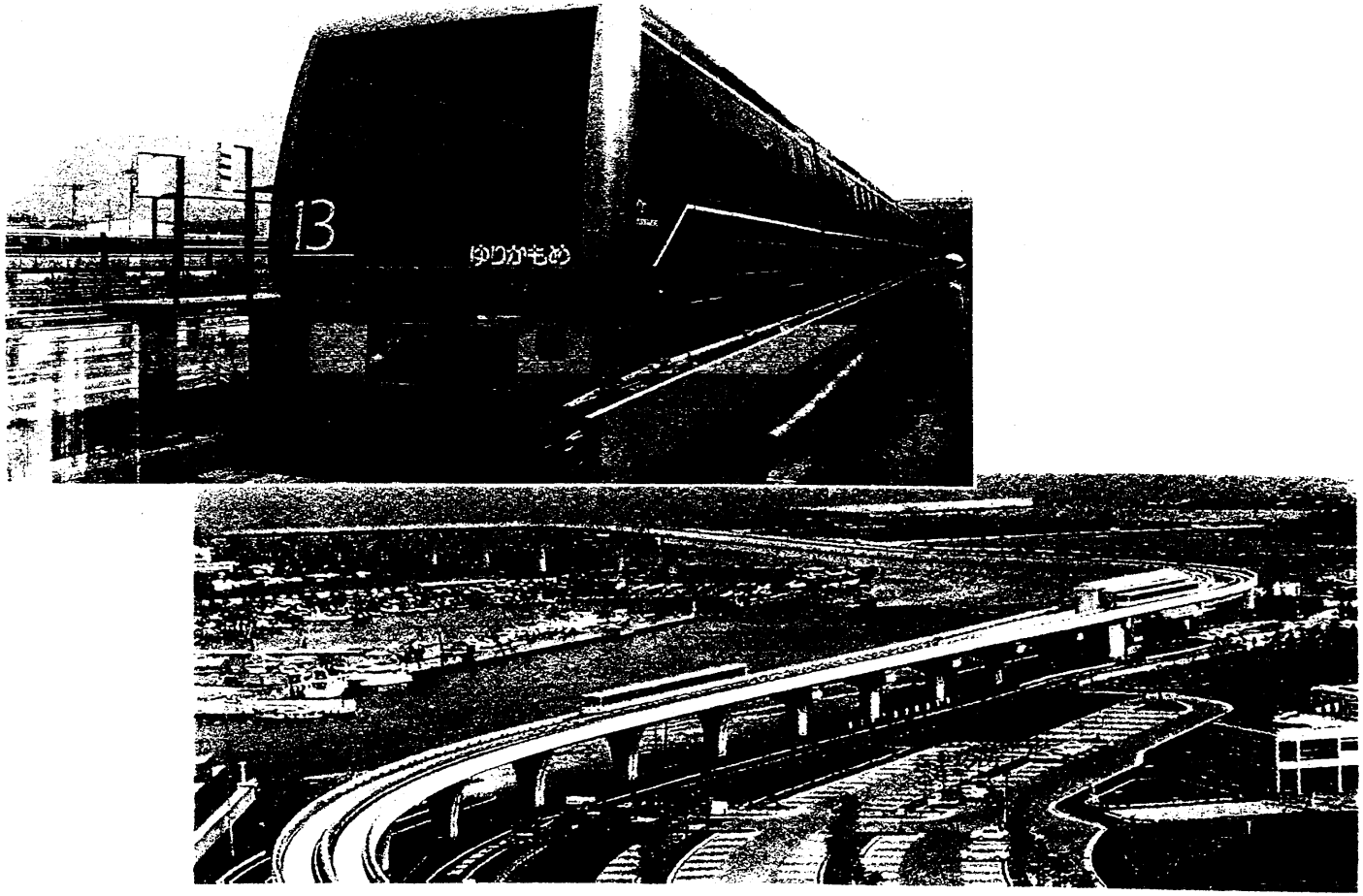
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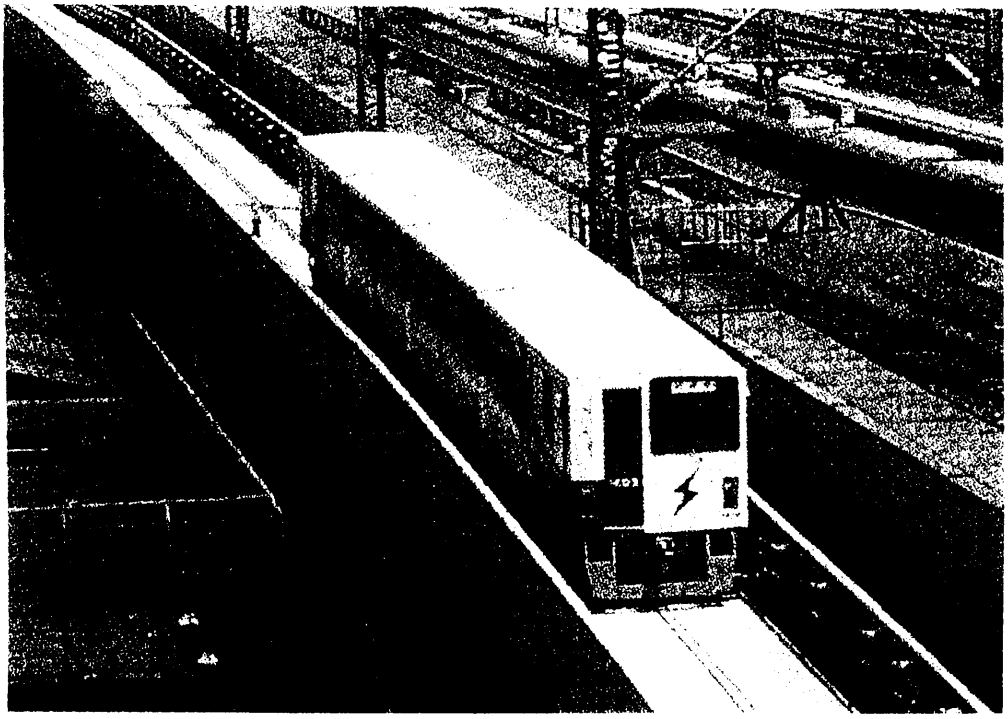
Urban Transit System

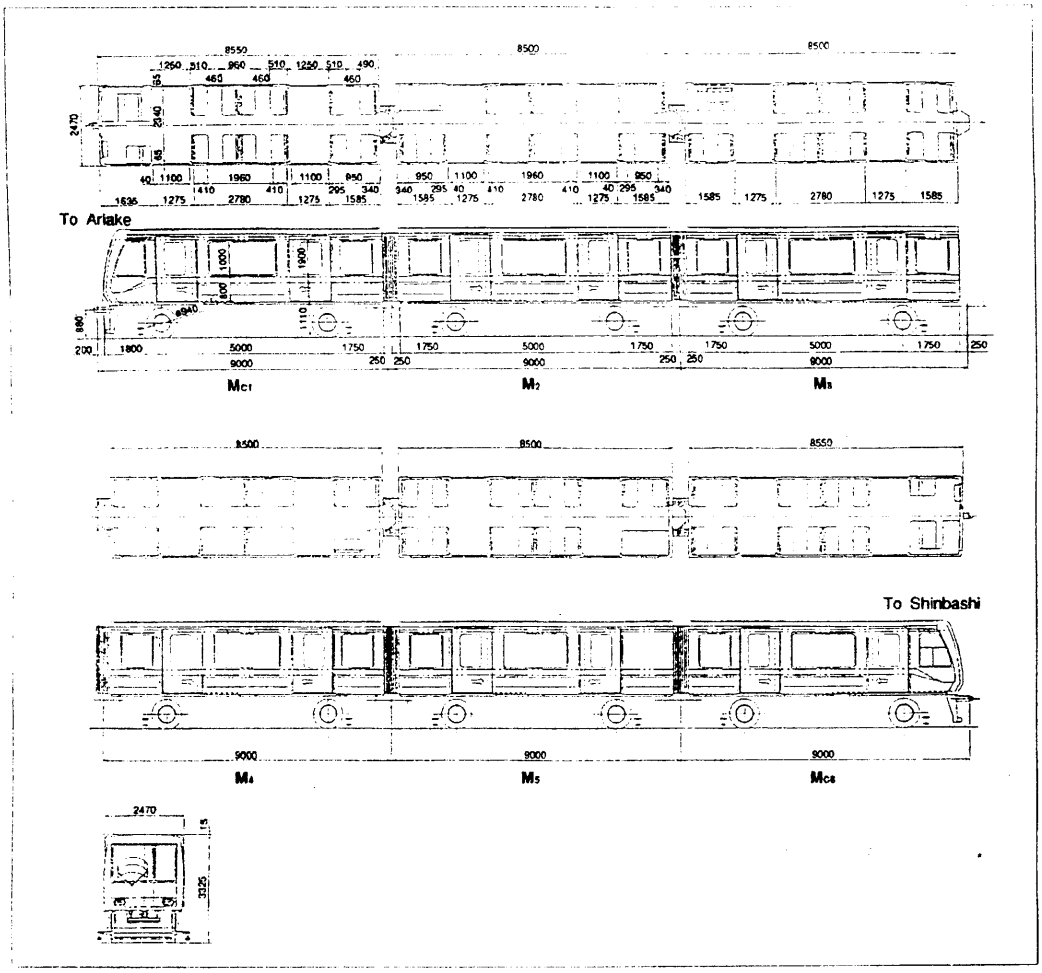
Automated Guideway Transit (AGT) - Characteristics (Con't)

- Stations - normally elevated with platform screen gates and mechanical ventilation. Unmanned operation. Ticketing contactless smart cards.
- Minimum requirement for plant rooms at station.
- Requirement for dedicated maintenance and stabling depot to be located at-grade.
- Approx. capital cost: $370M/km (for 20,000 pph capacity, excluding stations)
- Cost for a typical AGT station (elevated, 70m in length): $230M

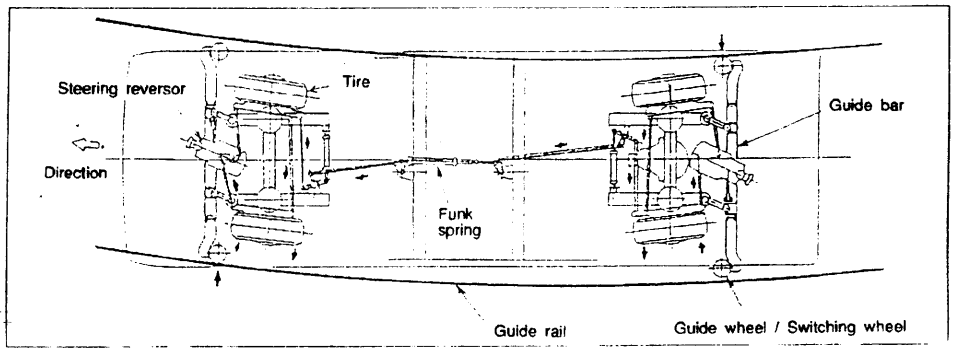


AGT Guideway

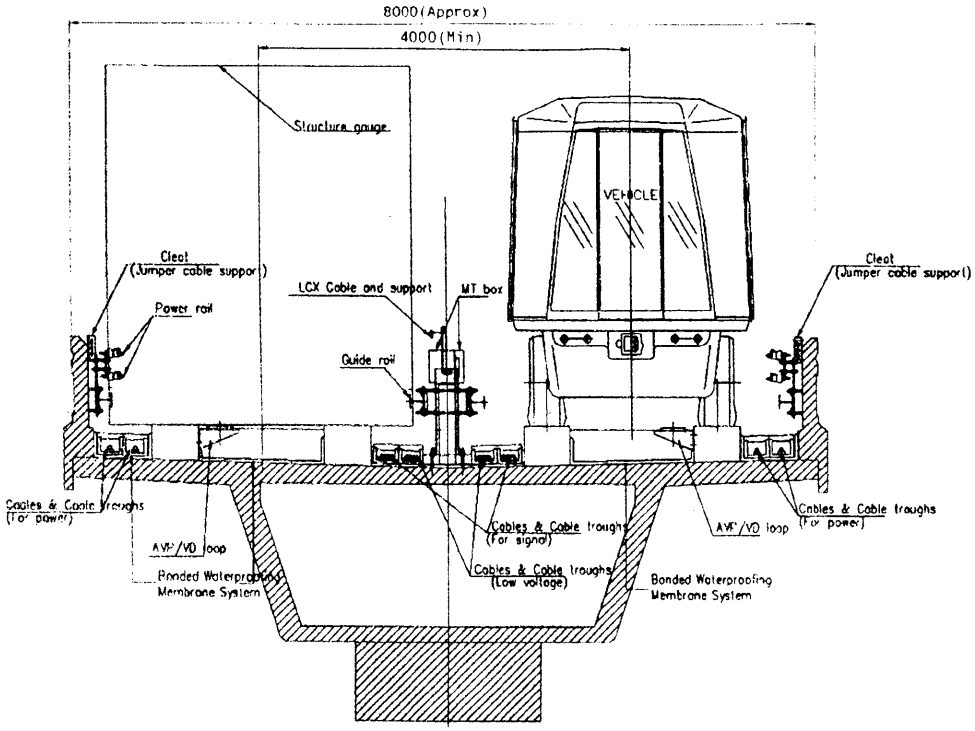
AUTOMATED GUIDEWAY TRANSIT (AGT)



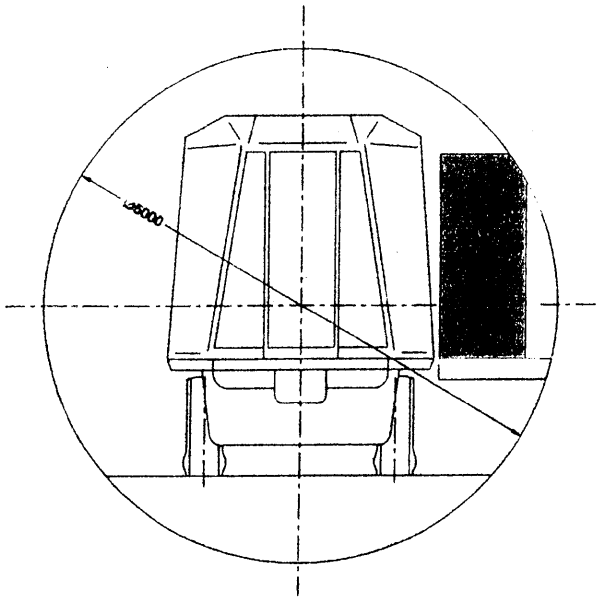
Train Formation



Steering Guide System



Typical Viaduct(Double Track)
Cross Section



Typical Tunnel(Single Track)
Cross Section

Automated Guideway Transit (AGT)

Urban Transit System

Comparison of Key Technical Features

Item	AGT	MTR
Maximum Speed **(Average)**	60 km/hr **(36)**	80 km/hr **(40)**
Max. Track Gradient	6%	4%
Min. Curve Radius	50m	300m
Overhead Structure (Single Track)	1.5m(deep)× 4.0m(wide) Concrete Guideway (I-Beam)	1.5m(deep)× 4.5m(wide) Box Girder Viaduct
Bored Tunnel	5.0m dia.	5.4m dia.
Noise Level	65 dBA(normal speed) 60 dBA(reduced speed)	90 dBA(normal speed) 85 dBA(reduced speed)

Urban Transit System

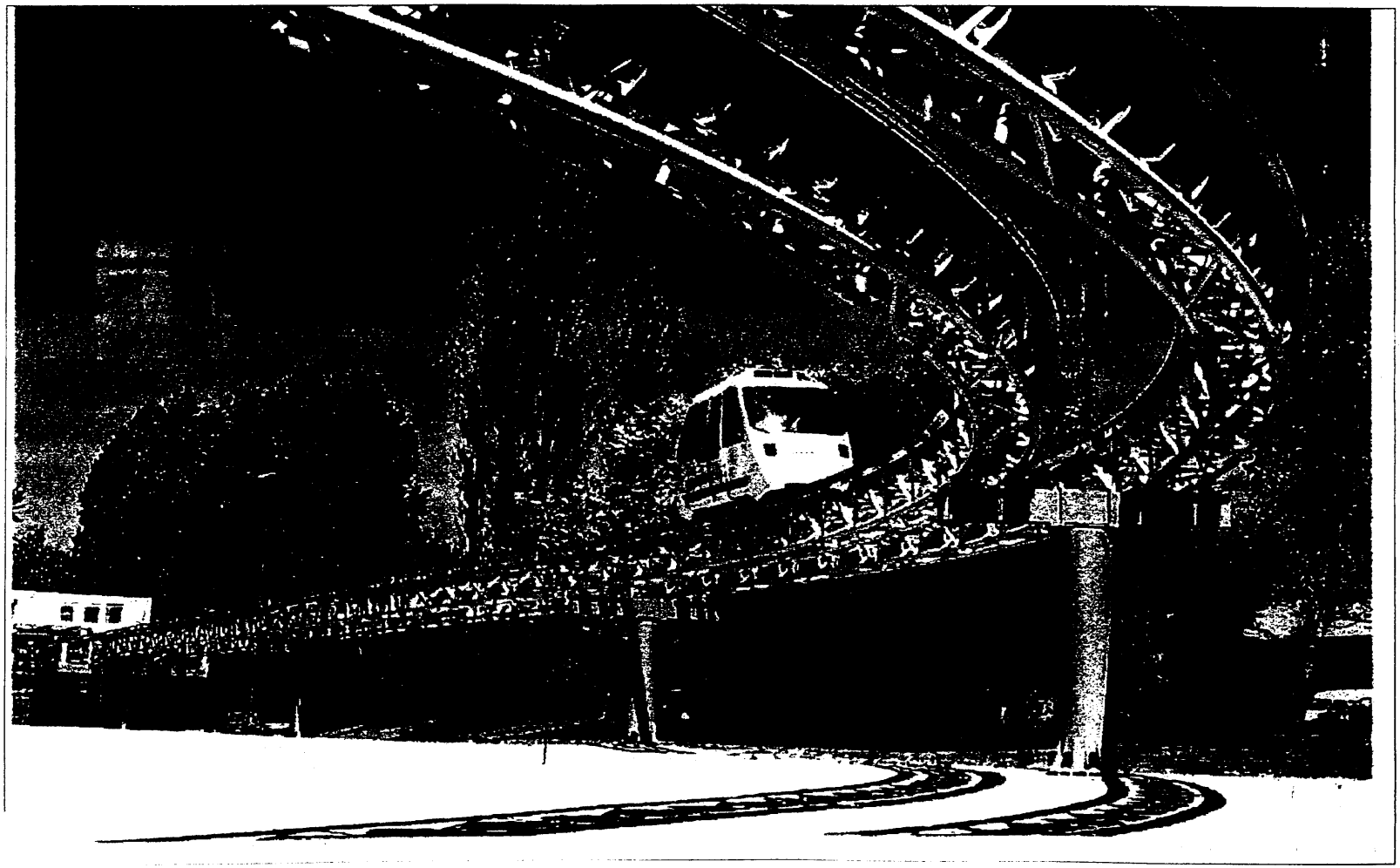
Cable-hauled Transit System
Cableliner (by Doppelmayr) - Characteristics

- Detachable funicular system drawn by a continuously moving cable adopts the concept of cable car with constant rope speed at 30 km/hr.

- No driving or control mechanism on board each vehicle, i.e. driverless and fully automatic operation. Main drive room at termini or intermediate station(s).

- Vehicle travelling on rubber wheels, reversing at termini by turntables.

- Steel truss to serve as track guideway, with steel columns spanning at 30m. Visually pleasing and environmentally acceptable supporting structures as compared with other self-propelled transit systems.



Track Structure of Cable-liner

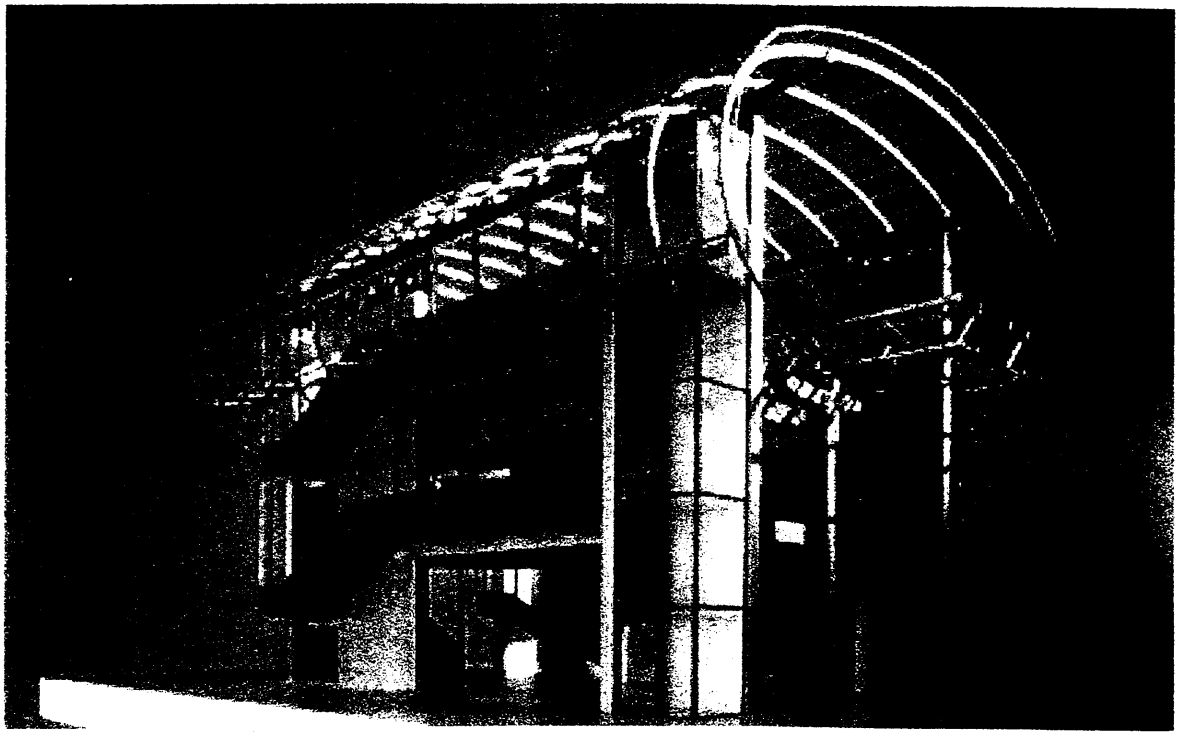
Cable-hauled Transit System
Cableliner - Characteristics (Con't)

- Capacity only up to 6,000 pphpd, with 50 pax/vehicle.
- Inside stations, vehicles to decelerate at creeping speed (of 0.28 m/s) for passenger boarding and alighting similar to cable car operation in Ocean Park.
- No need for maintenance depot all vehicles can be maintained inside a garage (on single level or multi-level) located next to any station.
- Approx. capital cost: $200M/km (for 6,000 pph capacity, excluding stations)
- Cost for a typical cableliner station (elevated, 20m in length): $50M

Doppelmayr Cable Car GmbH

Shopping Centre Project – Austria

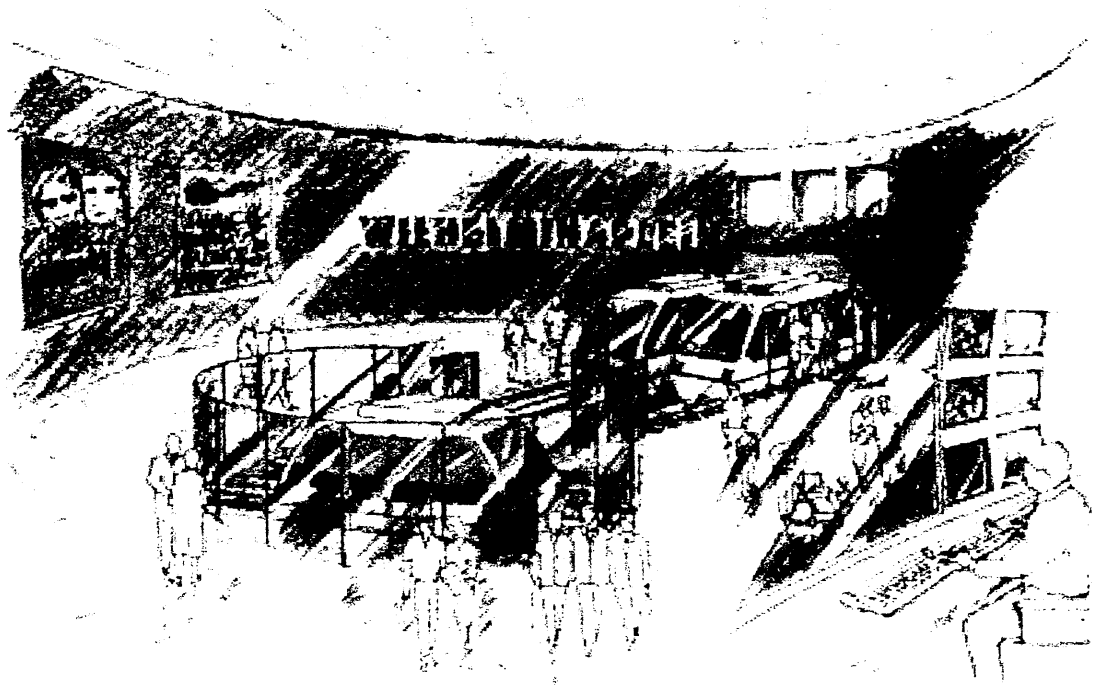
Terminal – Station Building



The CABLE Liner – the APM-System for the future

Doppelmayr Cable Car GmbH

CABLE Liner – Terminal

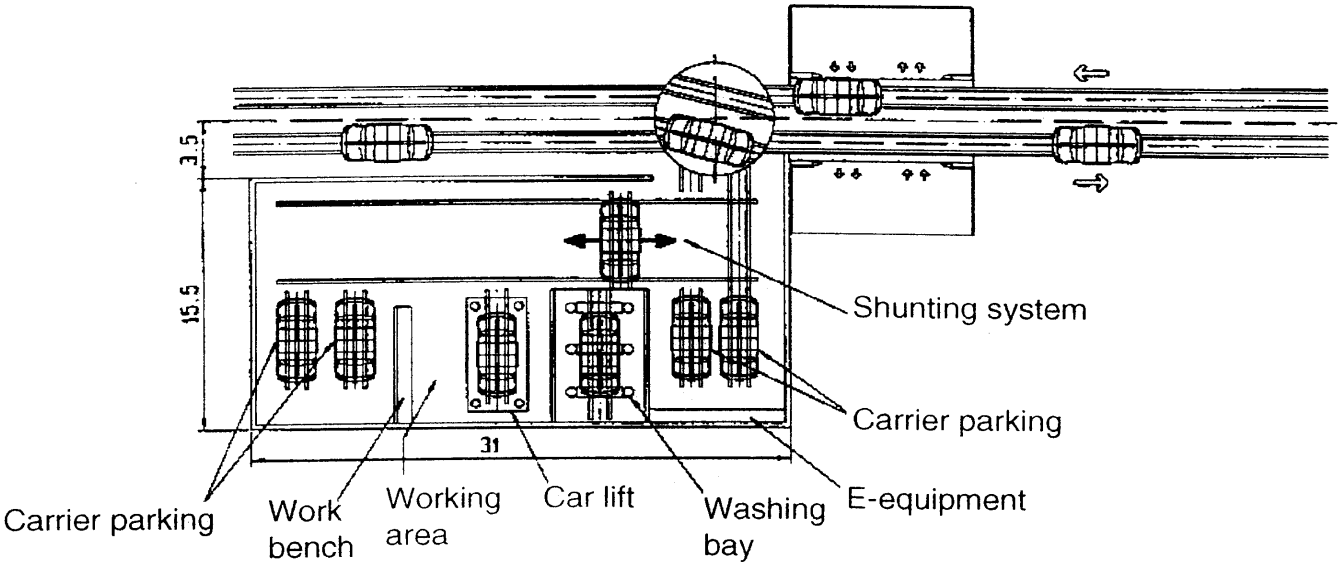


The CABLE Liner – the APM-System for the future

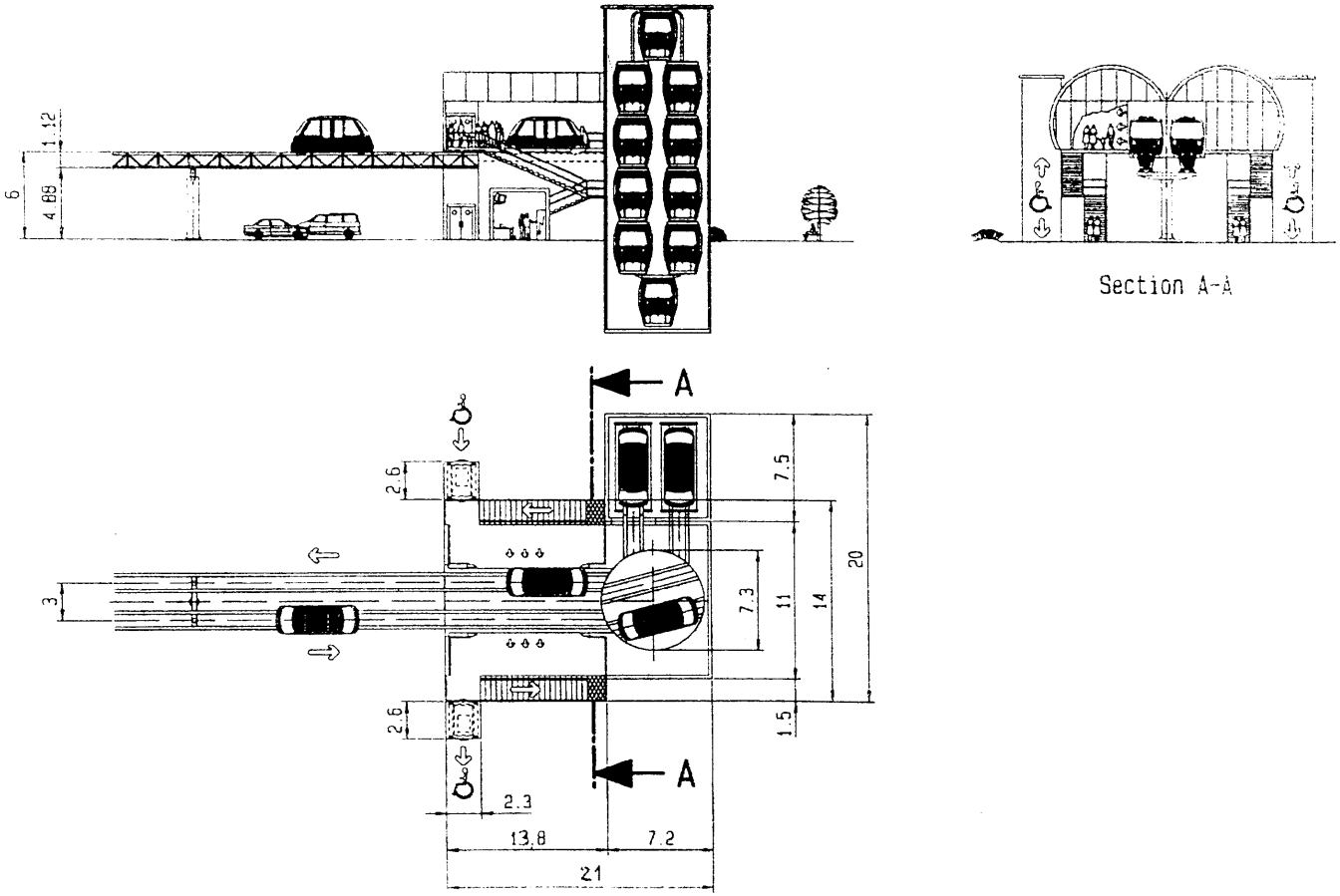
Doppelmayr Cable Car GmbH

Intermediate Station

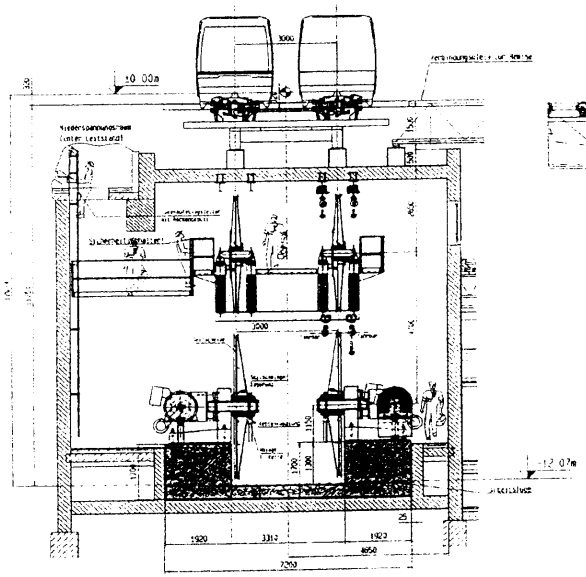
Parking and maintenance area
Standard APM (Automated People Mover)
Layout for airports and urban transit



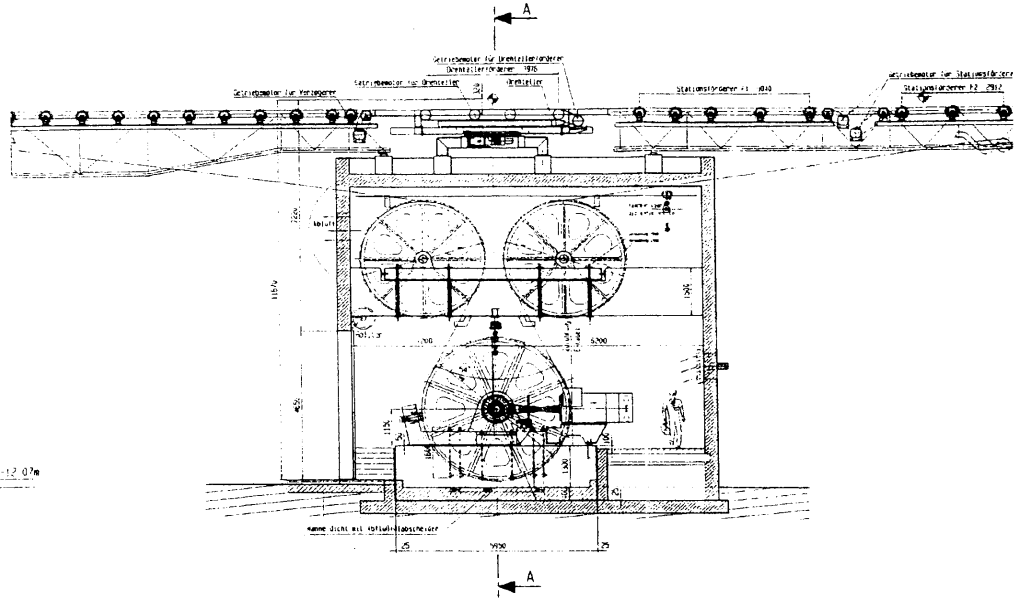
The CABLE Liner – the APM-System for the future



Cableliner Multi-level garage



Section A-A



Typical Cross Section

Cableliner Main Drive Room

Urban Transit System

Comparison of Key Technical Features

Item	Cableliner	MTR
Maximum Speed	30 km/hr **(rope speed)**	80 km/hr
Max. Track Gradient	15%	4%
Min. Curve Radius	45m	300m
Overhead Structure (Single Track)	Steel Truss on Steel Columns	1.5m(deep)× 4.5m(wide) Box Girder Viaduct
Noise Level	60 dBA	90 dBA(normal speed) 85 dBA(reduced speed)

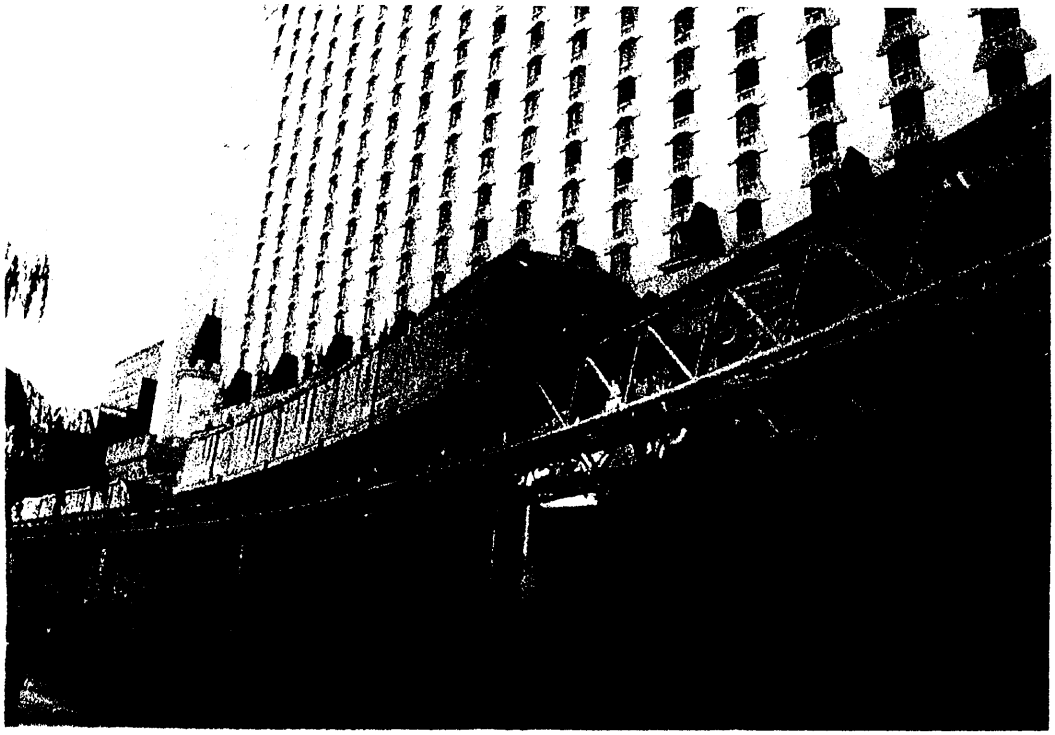
Urban Transit System

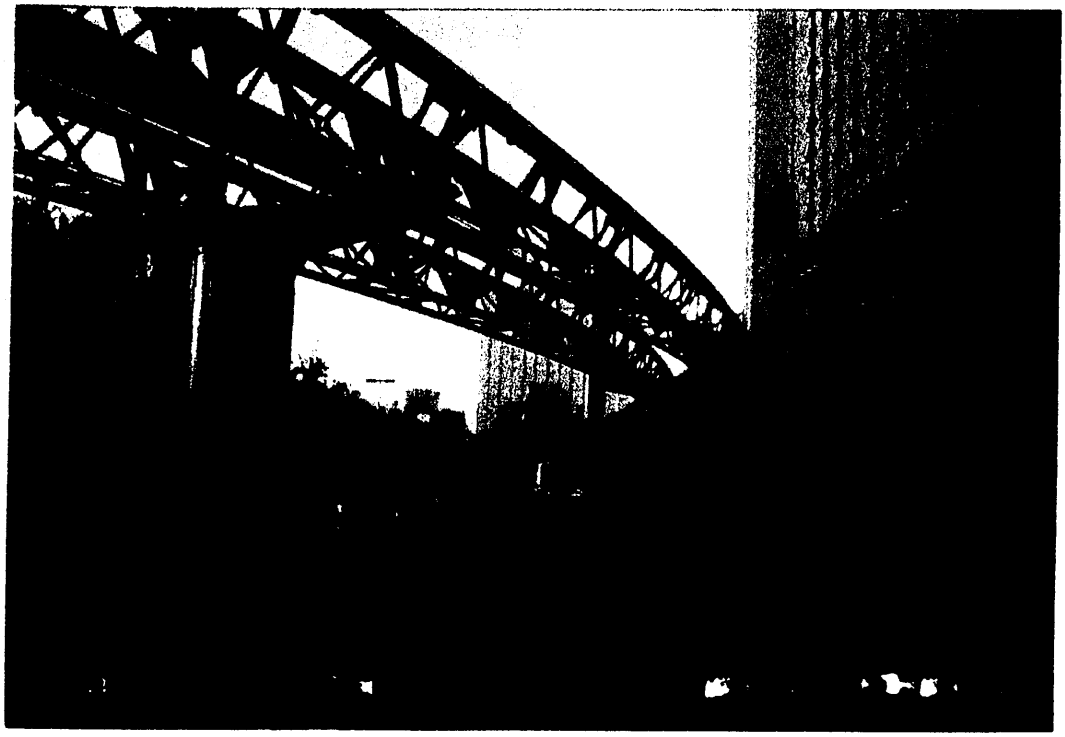
Cable-hauled Transit System
UTS (by Leitner) - Characteristics

- Rope-drawn funicular railway with vehicles fixed to the haul rope adopts the well proven technology of to-and-fro funicular systems such as the Peak Tram. Max. rope speed up to 50 km/hr.

- Same as the cableliner, no driving or control mechanism on board each vehicle driverless and fully automatic operation. Main drive room and control room at termini.

- Vehicles travelling on composite wheels (steel with rubber units) to reduce noise emission. Vehicles reversing at terminus by automatic (de)coupling devices.

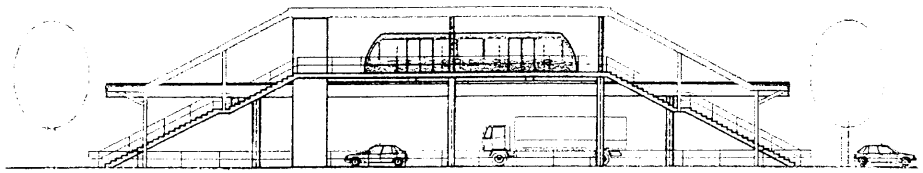




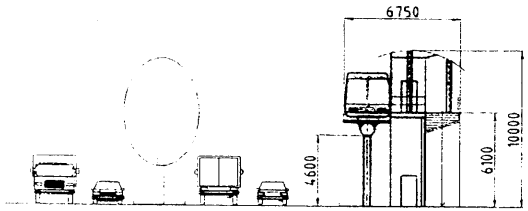
Urban Transit System

Cable-hauled Transit System
UTS - Characteristics (Con't)

- Steel truss and tubular sections to serve as track guideway, with steel or concrete columns spanning at 30m.
- Capacity up to 12,000 pphpd, with 140 pax per vehicle.
- Vehicles moving and stopping at all stations simultaneously. All stations must be at equal distance and with platform screen gates.
- No need for maintenance depot all vehicles can be maintained on an overrun track located at terminus.
- Approx. capital cost: $180M/km (for 6,000 pph capacity, excluding stations)
- Cost for a typical UTS station (elevated, 30m in length): $60M

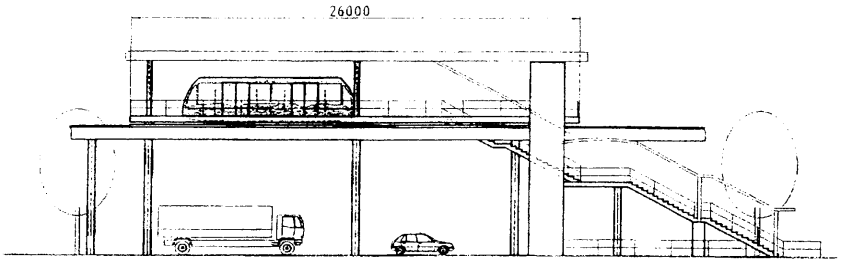


Elevation

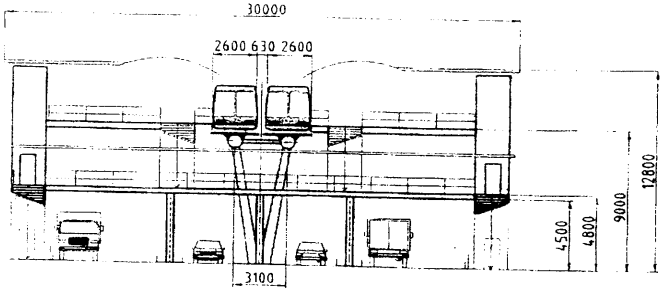


Front View

Single Platform



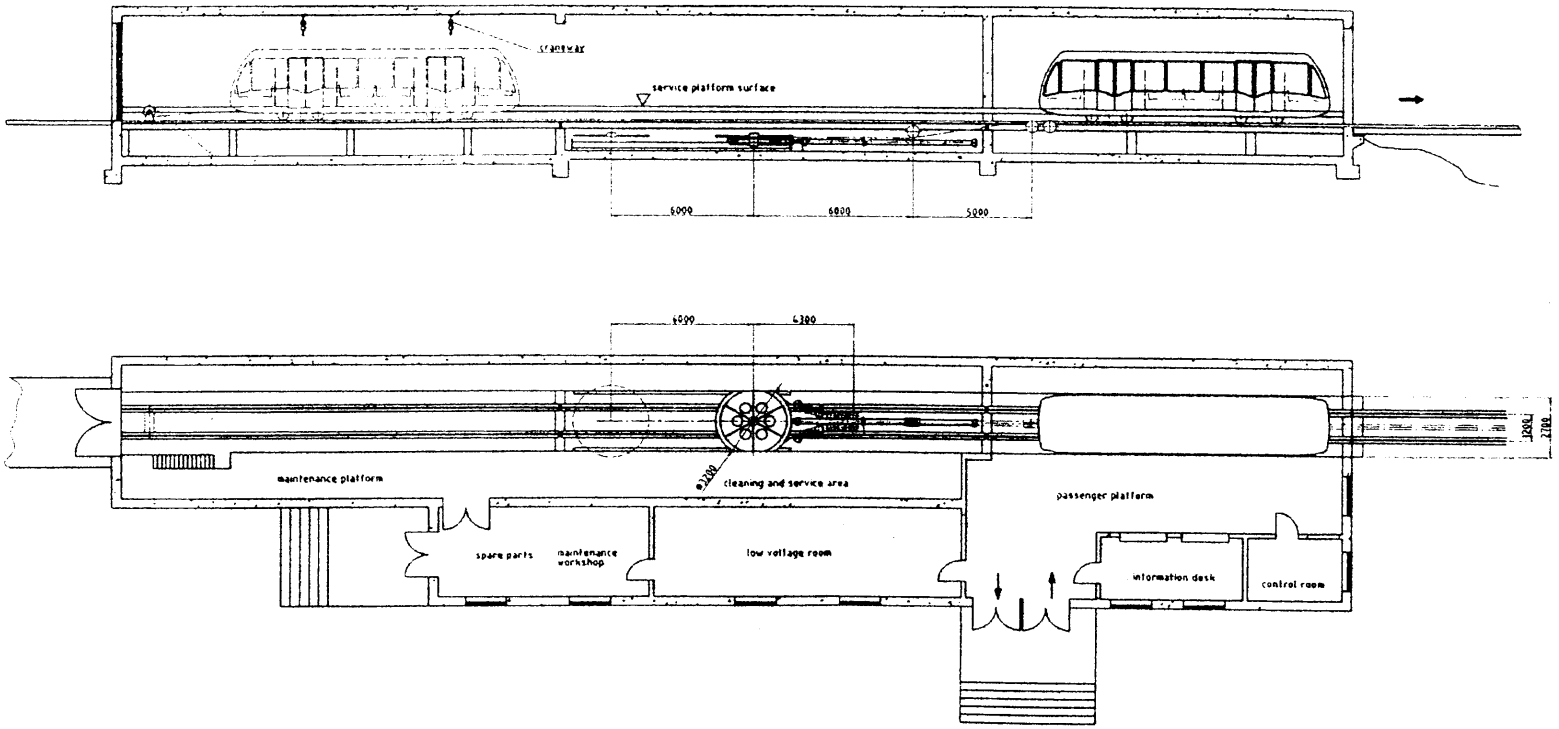
Elevation



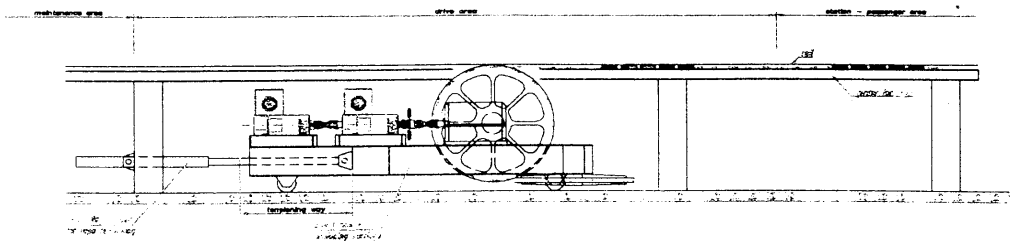
Front View

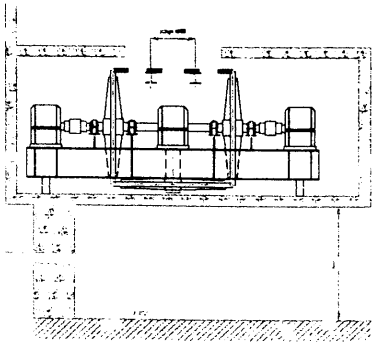
Double Platform

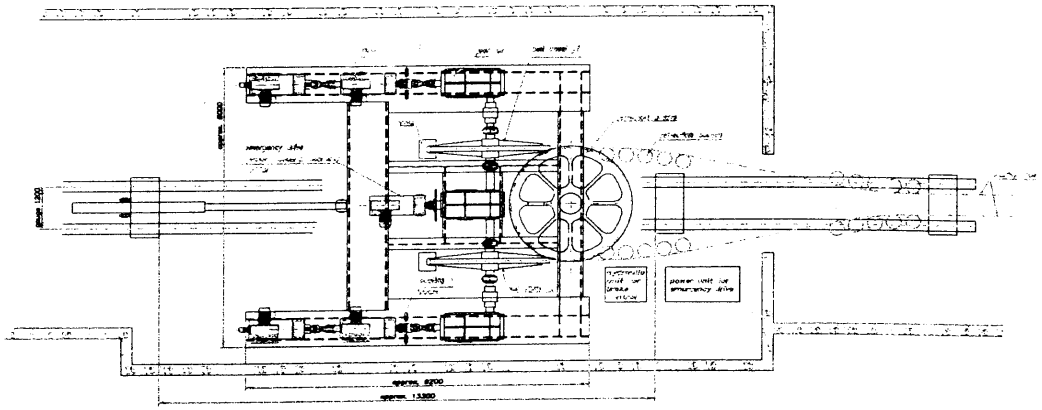
UTS Typical Station



UTS Maintenance Area







UTS Main Drive Room

Urban Transit System

Comparison of Key Technical Features

Item	UTS	MTR
Maximum Speed **(Average)**	50 km/hr **(36)**	80 km/hr **(40)**
Max. Track Gradient	20%	4%
Min. Curve Radius	60m	300m
Overhead Structure (Single Track)	Steel Truss on Steel Columns	1.5m(deep)× 4.5m(wide) Box Girder Viaduct
Noise Level	65 dBA	90 dBA(normal speed) 85 dBA(reduced speed)

Urban Transit System

Summary of System Comparison

Item	MTR	Monorail	AGT	Cableliner	UTS
Capacity (pphpd)	85,000 (312 pax/car)	30,000 (190 pax/car)	20,000 (125 pax/car)	6,000 (50 pax/car)	12,000 (140 pax/car)
Moving Gear	Steel Wheel	Rubber Tyre	Rubber Tyre	Rubber Wheel	Composite Wheel
Maximum Speed (Average)	80 km/hr (40)	80 km/hr (36)	60 km/hr (36)	30 km/hr (rope speed)	50 km/hr (36)
Max. Track Gradient	4%	5%	6%	15%	20%
Min. Curve Radius	300m	70m	50m	45m	60m
Overhead Structure (Single Track)	1.5m(deep) x 4.5m(wide) Box Girder Viaduct	1.6m(deep) x 0.8m(wide) Concrete Guideway(I-Beam)	1.5m(deep) x 4.0m(wide) Box Girder Viaduct	Steel Truss on Steel Columns	Steel Truss on Steel Columns
Bored Tunnel	5.4m dia.	6.5m dia.	5.0m dia.	N/A	N/A
Noise Level	90 dBA(normal speed) 85 dBA(reduced speed)	70 dBA(normal speed) 65 dBA(reduced speed)	65 dBA(normal speed) 60 dBA(reduced speed)	60 dBA	65 dBA
Capital Cost	$600M/km	$400M/km	$370M/km	$200M/km	$180M/km
Station Cost	$500M	$230M	$230M	$50M	$60M
Operating Cost	$50M/year	$20M/year	$20M/year	$15M/year	$15M/year