

WEDWAY PEOPLEMOVER-*HS*

Community Transportation Services



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Twenty Years of Transportation Solutions

It started in 1955 at Disneyland, with double-decker buses and riverboats. Already a "mini-city" in transportation activities, Disneyland introduced the first daily monorail service in 1959. The design and development of the monorail system reflected Walt Disney's personal commitment to not only build an attraction, but more importantly, to provide a transportation system for the future.

In 1964, the first Disney-designed PeopleMover system carried guests through the Ford pavilion at the New York World's Fair.

Then, three years later, Disneyland inaugurated a similar system which has carried 36 million people over 27 million passenger miles.

And now, at WALT DISNEY WORLD in Florida, the WEDway PeopleMover utilizes a linear induction propulsion system to economically transport thousands of guests silently every day. This unique transportation system has met the requirements of the Urban Mass Transportation Administration for application as a downtown people mover, and received that agency's certification in May 1976.

Community Transportation Services represents two decades of research, development, construction, testing and operation of transportation systems — systems that not only provide solutions to Walt Disney Productions' needs, but also provide solutions to the transportation needs of today's cities.

Community Transportation Services will develop the transportation systems and technologies to be showcased in the Experimental Prototype Community of Tomorrow (EPCOT) in a continuing effort to provide clean, efficient transportation to cities throughout the world.

System Overview

Disneyland's PeopleMover units consist of four adjoining vehicles forming a 16-passenger "train". Each train is propelled by electric motor-driven rubber wheels imbedded in a track guideway which is supported by an elevated concrete roadbed. Control systems permit varying speed zones along the route. Non-stop passenger loading and unloading is accomplished from a circular belt, rotating at the speed of the passing vehicle.

The third generation WEDway PeopleMover System, installed at WALT DISNEY WORLD in 1975, is a passive vehicle system which operates on guide rails and is propelled by track-mounted linear induction motors. Vehicle speed, collision protection, and spacing are computer-monitored through proximity and speed sensors which control power to each motor only as a car enters its reactive zone, thus optimizing energy utilization. Each five-car train moves 20 passengers at between one and 10 FPS (feet per second) at a minimum 20-second headway.

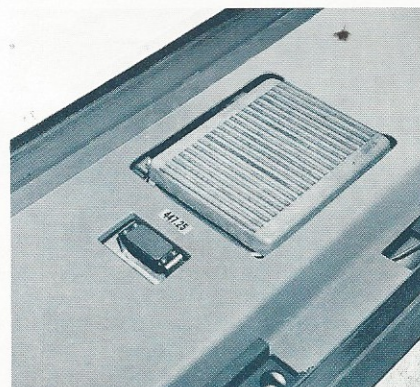
The chassis is supported by urethane-covered aluminum guide and support wheels which ride on steel tracks. The wheels, which are the only moving parts necessary to the car's operation, ensure low noise and friction levels. The track rails are supported by a welded steel frame and either concrete or steel piers.

The system is not affected by wind, heat, or moisture, and the only sound generated is from the contact of the wheels on the track as they roll.

Power requirement for the system is .061 KWH per passenger mile at 85 per cent loading, or 560 BTU's per passenger mile. This compares to private automobiles at 4,000 BTU's per passenger mile.



PeopleMoving at the New York World's Fair (1964)



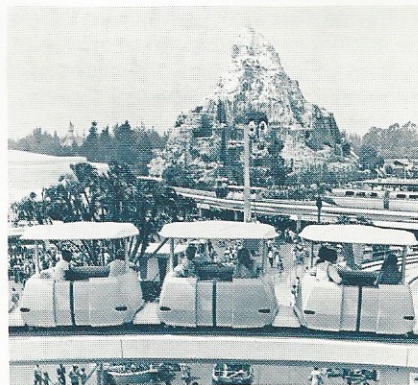
A linear induction motor at WALT DISNEY WORLD

Community Transportation Services WEDway PeopleMover is covered by several patents including:

3249065 — system configuration;
3412690 — system configuration;
3467026 — top tilting mechanism;
3530800 — motor hold-down and alignment;

DES209579 — car appearance and top; and

3974778 — linear drive system.



The Disneyland PeopleMover



The linear induction WEDway PeopleMover

The WEDway PeopleMover System installed at WALT DISNEY WORLD in July 1975, has carried more than 20 million guests on an .87 mile loop, and has operated eight to 17 hours per day, with 99.6 per cent operational readiness since opening.

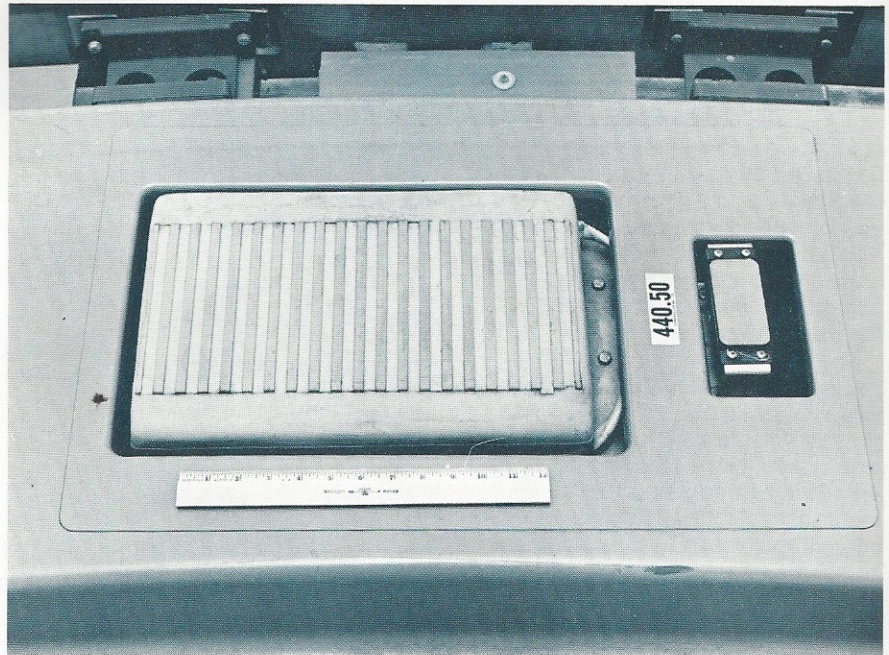
Operating costs reflect the low maintenance requirements and the efficiency of the linear induction propulsion system. In 1978, with over 4 million passenger miles traveled, operating costs remained below \$.09 per passenger mile for the third consecutive year.

Drive System

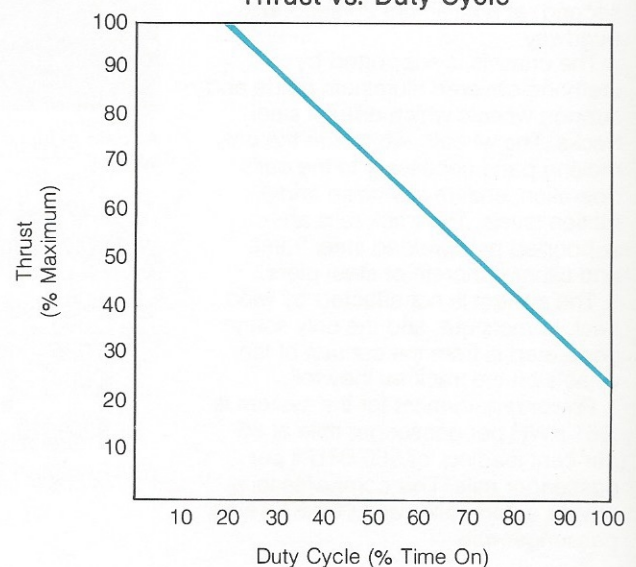
The WEDway PeopleMover is driven by a linear induction propulsion system which efficiently translates thrust directly to the vehicle without intervening gears, belts, or other mechanical devices. Rectangular (10" x 15" x 2-1/2" thick) electromagnetic motors are attached to the roadbed between the two guide rails. The motors react upon an aluminum-faced steel platen plate which is mounted beneath each car. The air gap between motor and platen is maintained at a separation of .150 inch, \pm .010 inch.

The motors are turned on by proximity sensors only when a platen approaches, magnetically attracting them in a forward direction. Vehicle speed, which is determined by speed sensors adjacent to each motor, is regulated by the duration of power applied to each motor.

The motors produce a maximum of 90 pounds thrust and require 240 volts, 60 Hz, 20 amps to operate.



Linear Drive Motor
Thrust vs. Duty Cycle





Motor spacing along the track varies with vehicle speed, grade, acceleration rates and number of vehicles connected together. For a constant velocity five car train, 10 feet between motors delivers the required thrust with approximately a 100% motor safety factor.

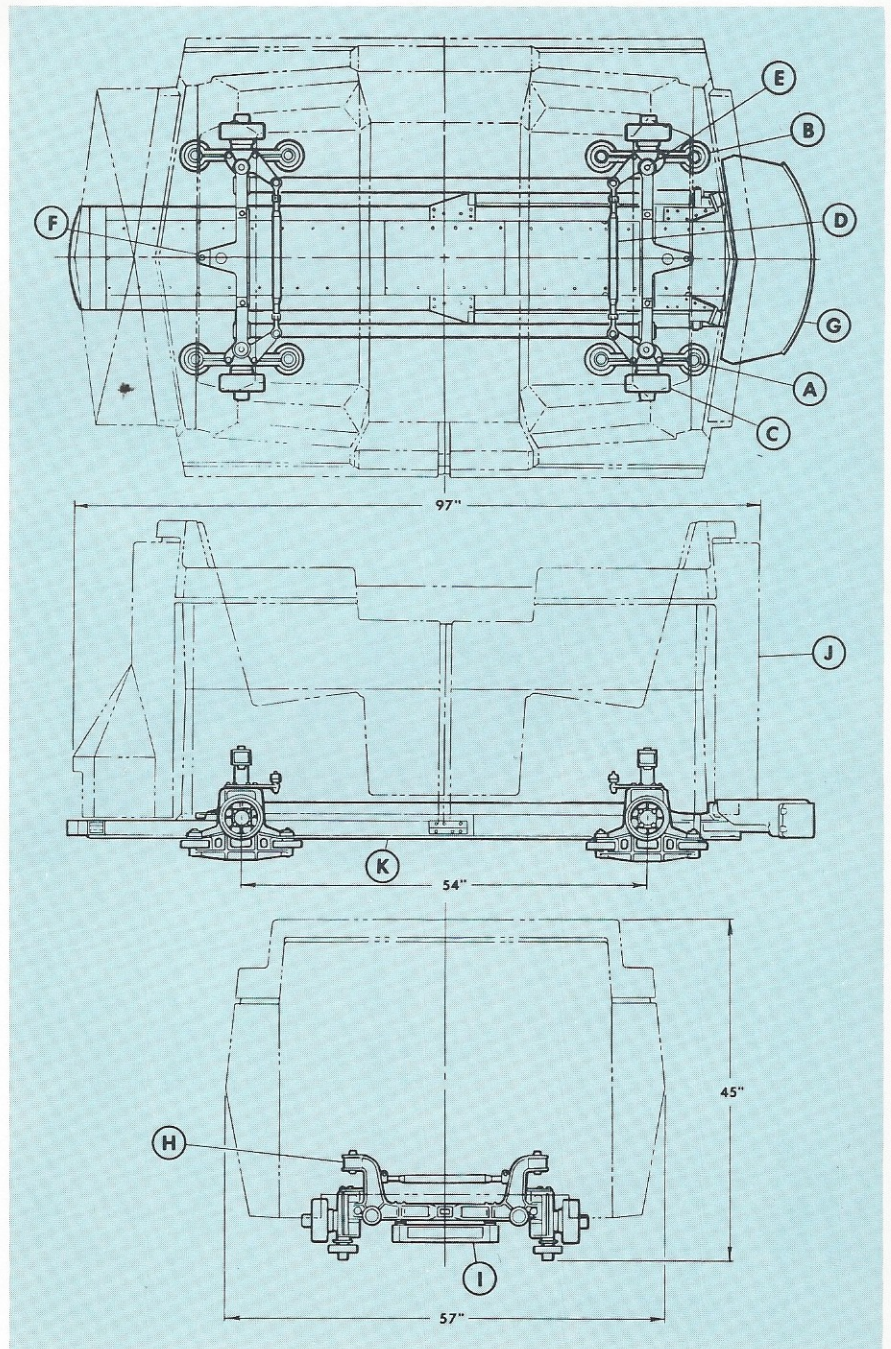
The motors, with normal use, have an unlimited life expectancy. The only routine maintenance required is minimum visual inspection of electrical connections.

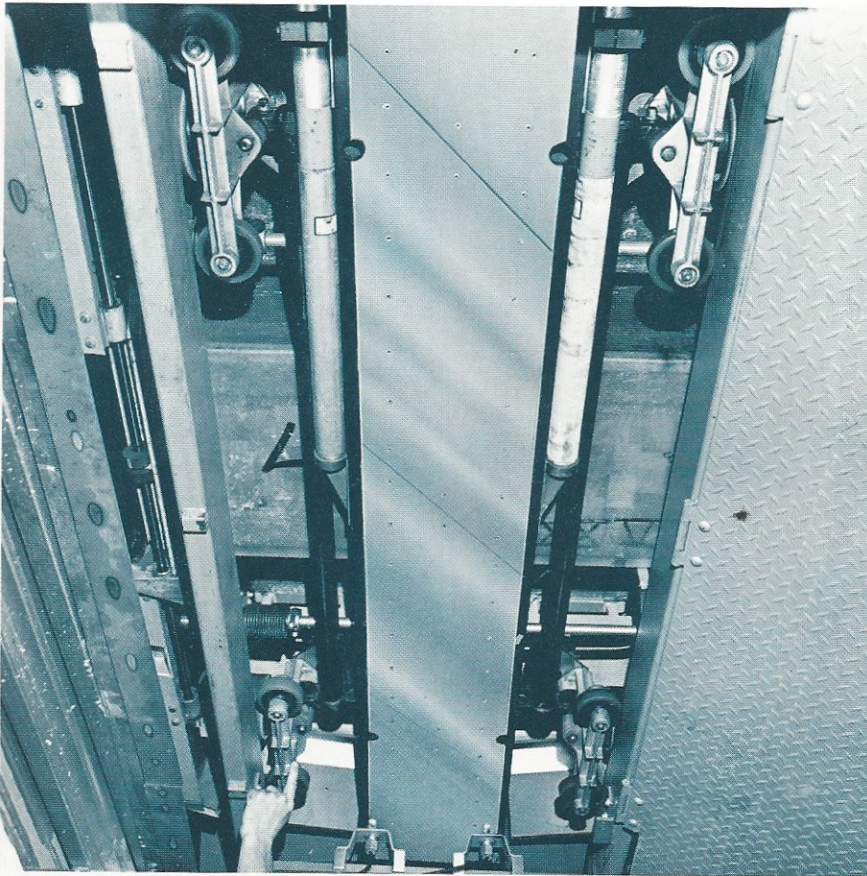
Vehicles

The vehicle consists of a body cushion-mounted on a solid chassis assembly, fitted with 12 urethane-covered aluminum wheels (eight guide and four support). Each bogie assembly is attached to the chassis through a kingpin, which permits the chassis to be steered from both the front and back. An aluminum faced steel platen attached to the underside of the chassis serves as the reactive part of the linear motor drive system. Since all propulsion power is supplied to the track-mounted part of the motor, the vehicle can remain completely passive. Front and rear bumpers absorb impact speeds of up to 10 FPS (feet per second) imparting only 1 G of force to the passengers.

LEGEND

- A BOGIE ASSEMBLY
- B GUIDE WHEEL
- C SUPPORT WHEEL
- D TIE ROD
- E KING PIN
- F DRAW BAR ATTACHMENT
- G BUMPER
- H BODY MOUNTING BRACKET WITH DAMPER
- I PLATEN
- J BODY
- K CHASSIS ASSEMBLY



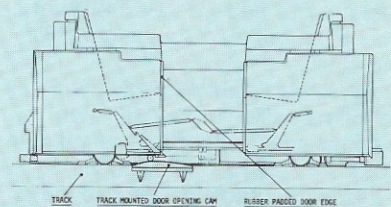


Underside view of vehicle showing platen in center and guide wheels.

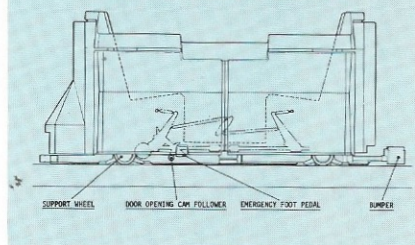
Currently, each vehicle seats four people comfortably and may be modified for six on a similar chassis. Door opening and closing linkage is operated automatically through cams installed in the load-unload area. It may also be released manually in emergency situations. The body can be fabricated in many styles, including open air, topped, or fully enclosed and air conditioned, from currently available materials. Empty vehicle weight is approximately 1,000 pounds.

Because the PeopleMover vehicle is totally passive, problems with traction loss due to snow, ice or rain, are minimized. Maintenance normally needed for intervening gears, transmissions, or pneumatic tires is eliminated.

Door Open Position



Door Closed Position



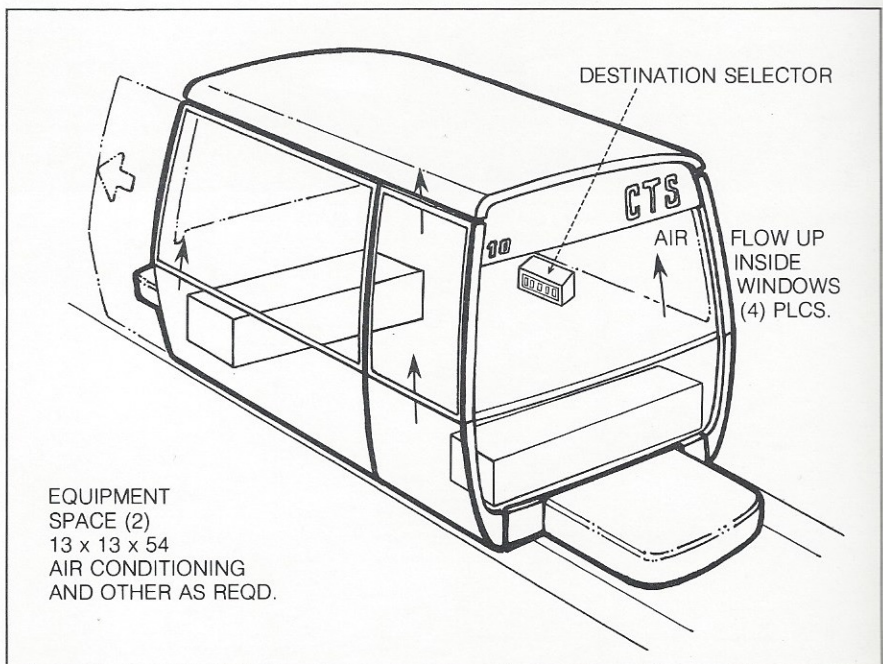
Automation

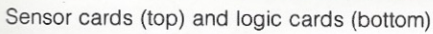
The WEDway system is presently controlled by hardwired motor logic cards, and monitored by a central computer. Provisions for computer control have been developed and tested for use in future applications.

The speed profile for the entire length of the system is preset by zone on the motor logic cards. Associated with each motor are speed and proximity sensors. The motor logic and sensors assure that the thrust applied to any vehicle anywhere on the guideway will be that required to maintain the predetermined speed. To maintain separation, a "motor inhibit zone" is created behind each train by the control logic, and varies in length depending on train speed.

The computer monitors the overall operation of the system, and reports in real time malfunctions of logic cards, sensors, motors, and other selected components. The integrity of the air gap between motor and platen is measured by track mounted sensors that provide audio and visual alarms should an out of tolerance condition exist.

At start-up, vehicles from every random position on the track are automatically spaced on the track. In addition, automatic distribution of vehicles into spur line storage areas when not needed is possible.





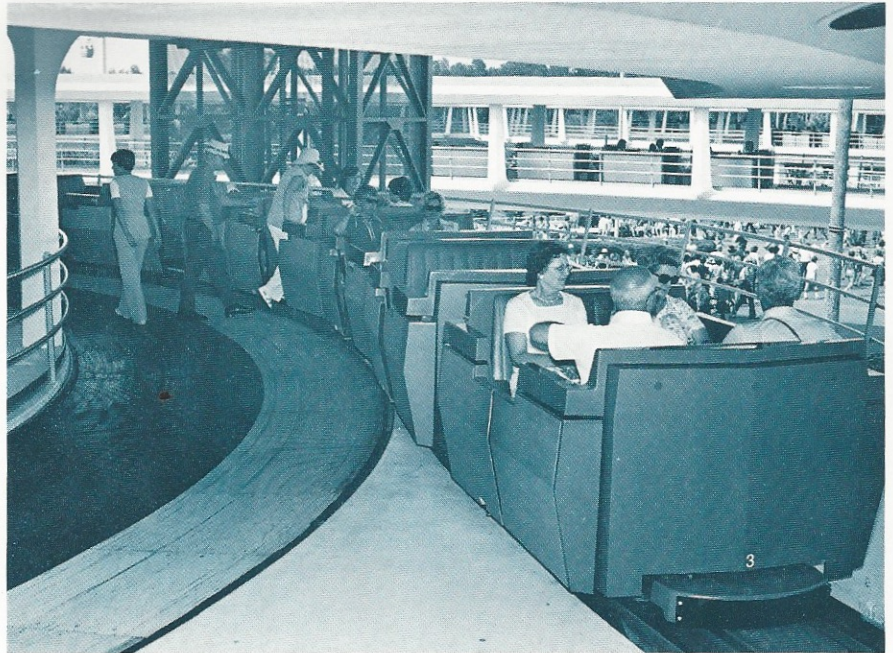
The current WALT DISNEY WORLD WEDway operates in a closed loop with continuously moving cars. A further developed system is being designed which will permit cars to remain idle until summoned. A "destination command" panel on each vehicle will enable passengers to push the appropriate button corresponding to their desired destination. Vehicle doors will close automatically, permitting the car to be dispatched to the new location. Off-line loading will enable vehicles to bypass unwanted locations and continue without time-consuming stops. Track switching will be controlled by the destination command in the vehicle. Full-stop stations using elevator-type doors have been developed for systems requiring static loading.

System Capacities

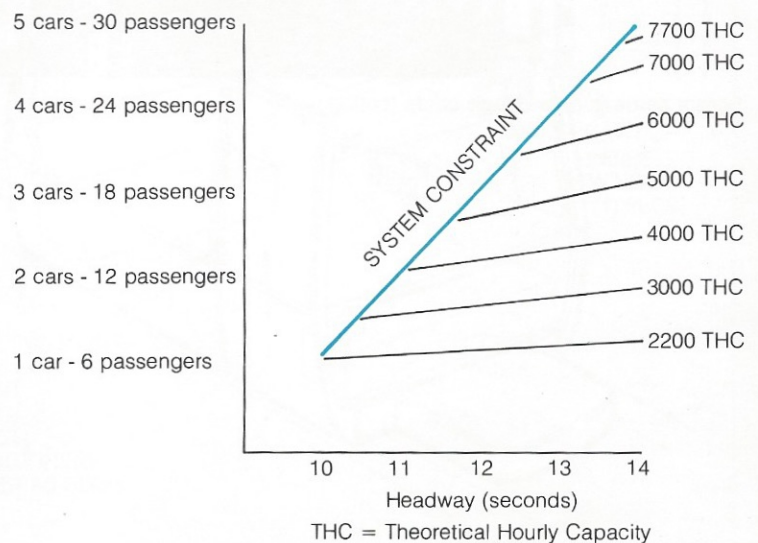
Currently, the vehicles accommodate up to four passengers and travel 2.7 FPS to 10 FPS (1.8 MPH to 6.8 MPH) at a headway of 20 seconds per five-car train. Six-passenger vehicles are now being developed which will have a speed range of 1 FPS to 20 FPS (.7 MPH to 13.6 MPH) with a minimum headway of 10 seconds per individual car. Acceleration and deceleration are limited to 2.5 FPS² for passenger comfort.

WEDway capacity is variable dependent upon load time and method, length of track, headway and, of course, number of vehicles. Currently, the WALT DISNEY WORLD system has an hourly capacity of 3,600 passengers. The capacity range is from 2,200 per hour for a single six-passenger car operating at a 10 second headway.

The WEDway's intermediate speed, multi-car system is a calculated departure from the traditional high-speed, high capacity car operating at headways of over one minute. While the WEDway has the capability for high speed operation, the cost effectiveness and reliability of an intermediate speed system give it certain advantages which should be carefully weighed against the minimal decrease in trip time gained from high speed operation.



System Capacity as a Function of Headway and Vehicle Capacity





Advantages of Intermediate Speed System:

1. Cost savings in guideway and equipment designs
2. Simplified control system
3. Passenger safety and comfort
4. Lower maintenance costs
5. Increased energy efficiency

Advantages of Small Vehicle System:

1. Greater system redundancy and reliability
2. Reduced loading/off-loading time
3. Increased flexibility in routing individual passengers
4. Shorter headways
5. Personalized transit

Loading System

There are two general ways in which passengers can be loaded. The fastest loading method for the WEDway system is the use of a moving walkway — currently in use at WALT DISNEY WORLD. Cars are loaded while in motion, from a revolving platform which is synchronized to the speed of the vehicle being loaded.

Current development on automatic switching will permit static loading in an environment which will resemble a horizontal elevator. High system capacity will be maintained through multiple loading positions.

Loading system design depends to a large degree upon the service WEDway is providing. If a large volume of passengers move between two fixed locations, such as between an airport satellite and terminal, then a moving walkway will provide fast loading for optimum system utilization. Conversely, if a passenger is offered several destinations, then static loading in a horizontal elevator atmosphere is more applicable. Studies indicate that either "through loading" (exit from one side and enter from the other) or separate load and unload positions consume approximately one half the time of loading and unloading from the same car doorway.

Operators are required on turntable loading systems to aid limited mobility passengers. Automatic off-line loading will permit these passengers to load at their own pace.

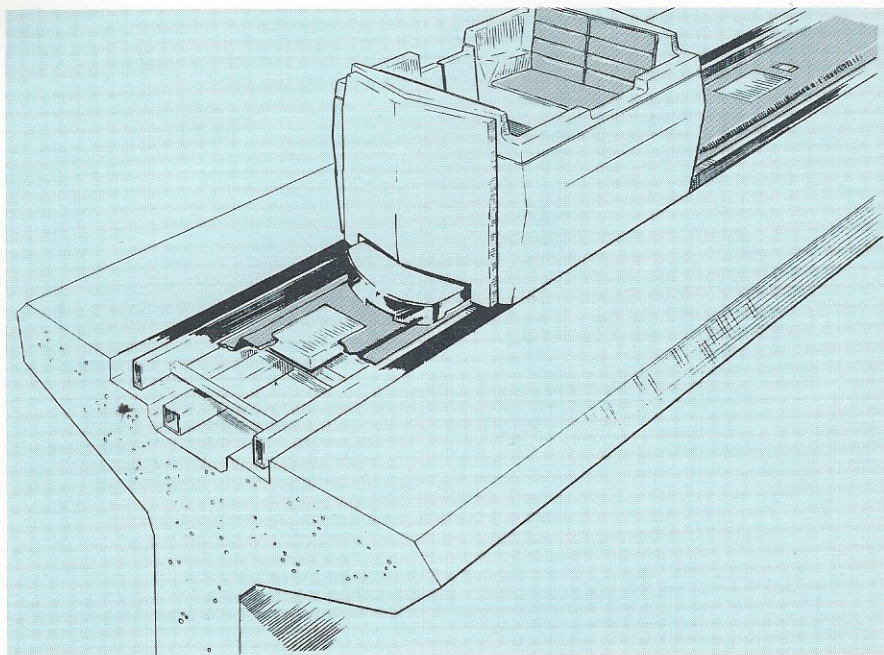
Track and Support

WEDway's track is constructed of structural steel tubing capable of containing power wiring. The track is bolted to a concrete or steel bed for support and rigidity. The motors, spaced between the track, are shimmed to the correct height to provide the necessary motor/platen air gap clearance. In elevated track applications, prestressed concrete or steel piers provide support. Foundation construction type is determined by local soil conditions.

Although current vehicles travel on a relatively flat plane, they can be propelled on any angle depending on the power supplied to the motors. Passenger comfort limits track angle to approximately 15% and track curves to a minimum 20 foot radius.

WALT DISNEY WORLD presently utilizes mechanical track switching between the main line and the spur track. Automatic switching has been manufactured and is undergoing final reliability tests. The switch can receive its control from the vehicle destination command.

Track support and pier profiles can be designed to aesthetically blend into the surrounding environment.



Collision Control and Braking

A "dead zone" behind each vehicle in high speed areas prevents power from being supplied to motors in that zone. (This acts to prevent vehicles from closing up to excessively short running clearance.) If the clearance between vehicles becomes less than an established minimum, an emergency stop is executed.

Normal braking is achieved by either turning the motors off and allowing the vehicle to coast to a stop or by reversing polarity to the motors thereby providing negative thrust, decelerating the vehicle at a given rapid rate. Mechanical fin-brakes are also available for stopping on grades and switch protection.

Emergency stops are accomplished by causing full reverse power to be applied to each motor. This power remains on the motor until sensors detect that the vehicle has begun to reverse direction, at which time all power to the motors is shut off.

The WEDway linear motor system is designed for high reliability and safety. Test data has shown that 50% of non-adjacent motors can be inoperative without affecting vehicle performance. An auxiliary braking system, currently used on other Community Transportation Services systems, is being adapted to the WEDway for use in case of power failure or grades.

Should complete evacuation of all cars be required, walkways and stairways adjacent to the track provide access to grade level. Shock isolating bumpers can absorb a collision speed of 10 FPS and impart only 1 G of force to the passengers.



Applications/Operations

Performance

In July 1975, Disney introduced the first linear induction WEDway PeopleMover which has now been in daily service at WALT DISNEY WORLD for over four years. The WEDway PeopleMover has proven to be a safe, reliable, and economical system. The following facts demonstrate the success of this system:

Safety – Over 20 million passengers have been carried without a single passenger injury. Over 3 million vehicle miles have been traveled without a vehicle collision.

Reliability – The operational readiness of the system has exceeded 99.8% for the last three consecutive years.

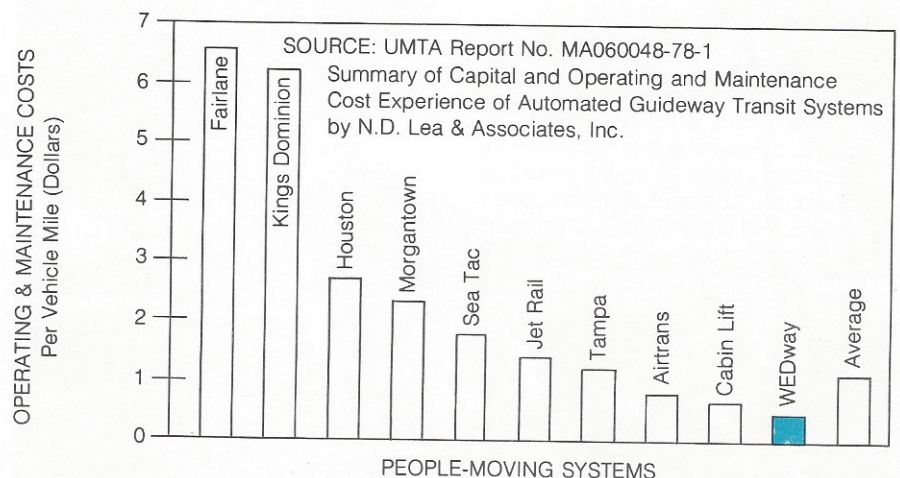
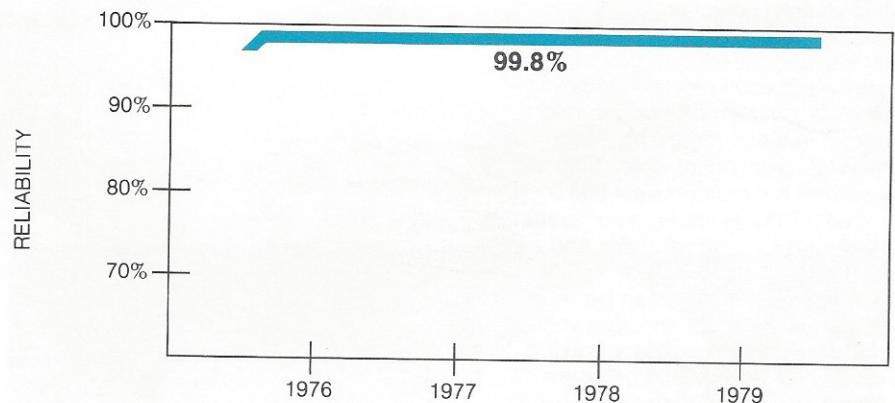
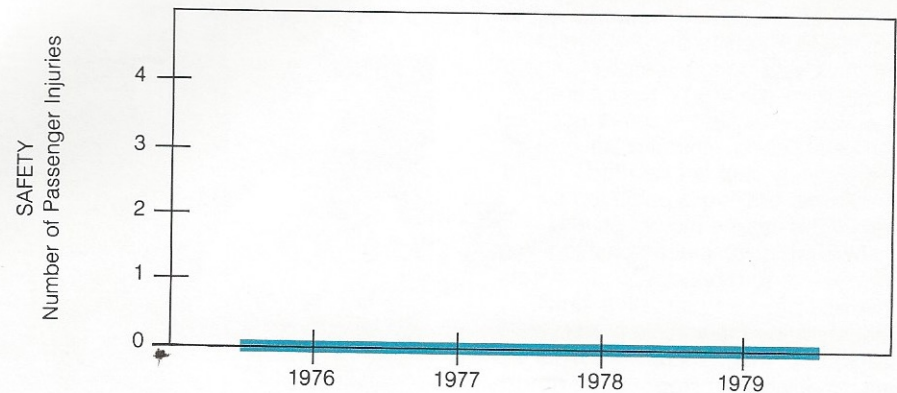
Operating Costs – The nine cents per passenger mile of total operating and maintenance cost was the lowest of any of the 10 people-mover systems evaluated by the Urban Mass Transportation Administration.

Applications

The application of the WEDway PeopleMover System for airports, shopping centers, and other developments is an extension of a time proven technology. Since 1955, Disney has designed and operated its own transportation systems which have transported over 250 million passengers over a half billion passenger miles.

A version of the WEDway PeopleMover was recently selected for installation at the Houston Intercontinental Airport. The 1.5-mile people-mover system will serve three airline terminal buildings, parking areas, and a hotel. Community Transportation Services is providing a total "turnkey" project, and will operate and maintain the system for the city of Houston for a period of five years. The Houston system includes the use of larger 12-passenger cars operating in trains of three cars each, full-stop elevator-type stations, mechanical braking, and speeds up to 15 mph.

WEDway PeopleMover Operating History



Walt Disney World System

Operating history

The first linear motor WEDway system installed at WALT DISNEY WORLD required two years to design and one year for construction.

Since its introduction in July 1975, the system has been in daily operation for over 19,000 hours, averaging 12 hours per day with 99.6% operational readiness.

Routine maintenance of the vehicles is done on a nearby spur line, while major rehabilitation of cars can be performed in an off-line maintenance facility. On a routine basis, checks are necessary on electrical connections, door alignment, and wheel tightness and wear. Annual maintenance operations include refurbishing wheels and bearings as necessary, repainting vehicle interiors, inspecting the track for wear, and thoroughly checking electrical systems. Because of the system's simplicity and resulting minimal maintenance requirements, the WEDway PeopleMover has traditionally had only two (2) full-time personnel assigned for routine maintenance activities.

Environmental

Vehicle noise is limited to contact between the wheels and expansion gaps in the track. The WEDway System creates no air pollution because it relies upon externally supplied electrical energy. In addition, it disturbs only that portion of the terrain where the piers are placed on the ground.

Since all drive and braking propulsion is supplied by the linear motor, there is no traction requirement between the wheels and the track. Consequently, heat, dust, wind, and moisture have no effect on the system's operation.

Any ice that may form on the motors is melted by the heat generated during the first few minutes of operation. The

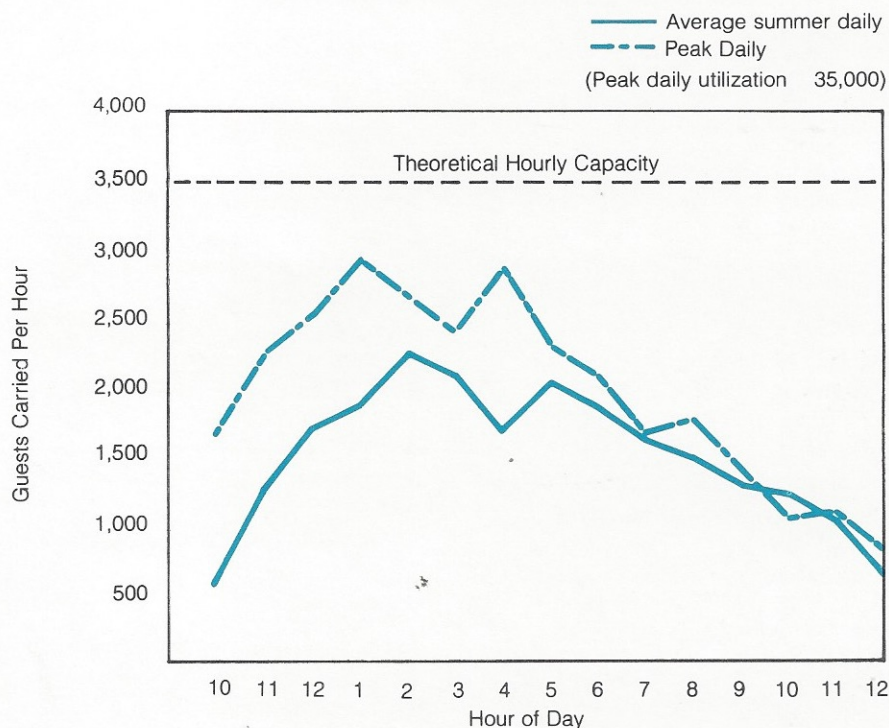
front bumper and track sweeper of each vehicle removes snow from the track. The only condition that would limit vehicle operation is excessive snow or ice which would completely prevent vehicle movement.

Ability to serve handicapped

Handicapped or limited mobility passengers can be accommodated on the WEDway. On moving sidewalk loading systems, these passengers must be assisted into the car. In static loading stations, handicapped passengers can enter the vehicle unassisted, at their own pace.



Walt Disney World WEDway Utilization



WEDway System Summary

Design

These design parameters below specifically apply to the WALT DISNEY WORLD WEDway PeopleMover. Variations in vehicle size, performance characteristics, and other features are readily available without major modification of the WEDway's flexible linear induction propulsion and control systems.

System Performance

MAXIMUM THEORETICAL ONE-WAY CAPACITY: 7,700 per hour

AVAILABILITY: Capable of operating in continuous closed loop or demand responsive destination controlled

RELIABILITY: 99.8% Operational Readiness (Oct. '75-Oct. '78)

1978 Operational: 4,732 hours

1978 Non-Operational:

Mechanical 4 hours 13 minutes

Station Equipment 3 hours 53 minutes

Electrical 0 hours 42 minutes

Total 8 hours 48 minutes

Vehicle Performance

VELOCITY RANGE: 1-20 FPS (.7—13.6 MPH)

MAXIMUM GRADE: 15%*

ACCELERATION/DECELERATION: 2.5/2.5 FPS²

LATERAL FORCE: .62 G**

MAXIMUM JERK. (emergency stop condition): 11.6 FPS³ (7.9 MPH/sec²)

OPERATIONAL JERK: .77 FPS³ (.53 MPH/sec²)

STOPPING PRECISION IN STATION: ± 6 in.

DEGRADATION IF GUIDEWAY IS WET: None

DEGRADATION FOR SNOW AND ICE: Minimal, if car is able to be moved

VEHICLE DESIGN CAPACITY: 4 passengers per car, 5 cars per train

ENERGY CONSUMPTION: .061 KWH per passenger mile at 85% loading 90% power factor,

.090 KWH per passenger mile at 55% power factor under actual loading and operating conditions

Vehicle

BODY TYPE: Open topped or enclosed

WHEEL BASE: 54 inches

OVERALL LENGTH: 100 inches (with bumpers)

OVERALL WIDTH: 57 inches

OVERALL HEIGHT: 45 inches (open car)

EMPTY WEIGHT: 1,000 lbs.

GROSS WEIGHT: 1,600 lbs.

DOORWAY WIDTH: 22 inches

AIR CONDITIONING/HEAT: Available

COMMUNICATIONS: Available

AUTOMATIC DESTINATION

SELECTION: Available

Suspension

TYPE: Rigid bogie with shock dampened body

DESIGN LOAD: 100% safety factor

LATERAL GUIDANCE: Front and rear guide wheels which steer the bogie through kingpins and tie rods

Propulsion and Braking

MOTOR TYPE: Linear induction, active track motor, passive car platen

MOTOR PLACEMENT: Variable

MOTOR RATING: 240V, 60Hz, 3Ø, 20A, 90 lbs. thrust, 4.5" pole pitch, 25% and 50% duty cycles

MOTOR CONTROL: Speed and proximity sensors operating through control logic

SERVICE BRAKING: Linear motor reverse polarity

SAFETY BRAKING: Mechanical available

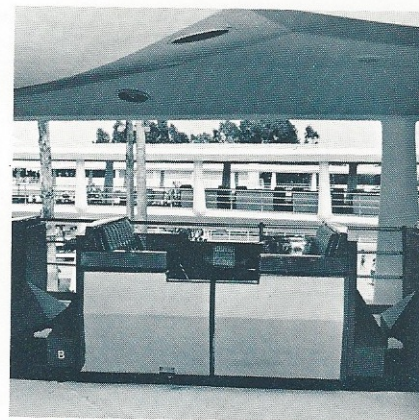
Switching

TYPE: Automatic, vehicle destination controlled

SWITCH TIME (lock to lock): 3 seconds (approximately)

SPEED THROUGH SWITCH: 20 FPS

HEADWAY THROUGH SWITCH: Same as track



Guideway

TYPE: Concrete or steel supporting steel track

MINIMUM TRACK RADIUS: 20 feet*

SINGLE LANE ELEVATED GUIDEWAY:

Maximum span 70—90 feet

Cross section width 8'4"

Cross section height 36"—48"

Design load 500 lb/ft (supportive load)

Stations

TYPE: Off or on line

TYPE BOARDING: Static off line, Moving walkway on line

BOARDING CAPACITY: Variable

MAXIMUM WAIT TIME: Variable

VEHICLE IN STATION DWELL TIME: Variable

AVERAGE STATION SPACING: Variable

Environmental Factors

NOISE LEVEL: Negligible, limited to wheel noise when contacting expansion joints in track

AIR DEGRADATION: None

TERRAIN DISTURBANCE: Limited to alignment of piers

* Limitation is based on passenger comfort.

** Theoretical number based on 20 FPS, 20' radius, and no track banking; passenger comfort determines specific design level.



Community Transportation Services

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