Ropeway People Movers for Ski Resorts

by **Andrew S. Jakes***

Abstract

Las Vegas, Reno, Sun City, Foxwoods, Tunica, Broad Beach, and several other international mega-resorts, have discovered that People Movers (Automated Guideway Transit) improve their image and subsequently attract new customers. In addition to presenting the rope-propelled People Mover technologies, this paper reviews how specific installations have solved visitor circulation needs in many hotel resort complexes in Las Vegas and elsewhere. This approach can be duplicated to many ski resorts worldwide since the level of ridership in Las Vegas frequently exceeds levels typically found on ski resort shuttle bus systems worldwide. We particularly focus on existing, proven technologies and specific installations, including ropeway Horizontal Elevators (Mandalay Bay, Mirage, Primadonna, and Circus-Circus Automated People Mover installations).

People Mover systems represent major changes and advances in equipment, facilities, operations, and services in comparison with conventional rail, bus, taxi, and other street modes. System performance and capacities can be tailored to match expected loads and a broad range of performance and operational requirements. Suppliers usually claim, with justification, that they can adapt their product to buyer's specific needs. Vehicle size can be expanded or reduced. Seats can be added or removed from vehicles. Various grades and curves can be accommodated by altering guideway design and speeds.

Riding the circulation People Mover system can be as convenient, safe and comfortable as riding a modern elevator. Stations can be sufficiently numerous to provide development-wide access. Passengers experience little or no waiting for vehicles. The operation can be environmentally friendly with no emissions, very little noise and minimum visual impacts. The system could be fully integrated with both existing and future developments. This inherent design flexibility of People Movers has been demonstrated very well in Las Vegas and other gambling oriented resorts, and now can be duplicated in various ski resorts.

Ropeway Technologies

Cable propelled streetcars used to be widely applied in metropolitan areas, including several US cities. The City of San Francisco Chapter has provisions that say: “There will be a cable car in San Francisco”. The 100-year old cable railway used to have over 100 miles of trackway in the city, much of which being later replaced with electric trolley buses and light rail. The remaining four lines offer 11 miles of service with 26 cars operating every 3 minutes with a 9.5 mph speed. The Cable Railway

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contributes over 26% to the Municipal Railway's (MUNI) revenues carrying approximately one million passengers per month. This operation defies a common misperception that cable systems are limited by length (it is the performance and design flexibility which limits their applicability).

However, the modern cable propelled People Mover has been derived from ski resort applications rather than for urban cable car fleets. It is resultant from the simple fact that that none of the urban cable car companies have survived. Today's cable People Movers are based on funicular (for fixed grip systems) and gondola (for detachable grip systems) technologies.

We have divided ropeway People Mover systems into the following categories:

- Bottom-supported and suspended
- Fixed and Detachable Grip
- Available, Under Development, and No Longer Available.

Figure: "Ropeway People Mover Technologies" analyzes the technology development trends set by suppliers (not necessarily by the market). It shows that the majority of technologies are bottom-supported (70%). It shows a clear preference for fixed grip, although detachable grip People Mover systems are now evolving to compete with more flexible self-propelled People Movers. It indicates a substantial level of new developmental activity for this over 100 years old technology (23% of all systems).

Table: "Ropeway People Mover Test Tracks" lists currently active test track facilities. All of them are very recent which indicates a major commitment by cable system suppliers to enter the People Mover market to supplement their somewhat declining skier transportation business. There had not been any ropeway test track facilities since the 1970's when the initially ambitious Poma 2000 development program was turned into reality by its installation in Laon, France. Shortly thereafter, the PomaBus test track (a different technology developed by Poma) was also abandoned.

Among the cable test tracks, the extensive Poma-Otis test facility currently under construction in Grenoble presents a major step forward in the advancement of practical cable solutions.

Table
Ropeway People Mover Systems

Status	Bottom-supported ropeway People Mover Supplier	Description
Available	Otis Poma-Otis Poma Soule Doppelmayr-Siemens Leitner SDI	Otis Shuttle II Otis Shuttle I Fixed/Detachable Grip PM SK Cable Liner
Under Development	Poma-Otis Poma Garaventa Waagner Biro	Detachable Grip Saturn APM
No Longer Available	Von Roll Poma VSL	 Poma 2000 Metro Shuttle 6000

Status	Suspended Ropeway People Mover Supplier	Description
Available	Poma Delta V Aerobus International	Trasse Aerobus
Under Development	Waagner Biro Skyrail Niigata/Mitsubishi/Kobe Steel/Shimizu	C-Bahn Skyrail Sky-Cable
No Longer Available	VSL MVG/Waggonfabrik Uerdingen Alsthom-Neyrpic	 Aerometro Tele Rail

Note: Aerial Tramways and Inclined Elevators not included.

Table
Ropeway People Mover Test Tracks

Supplier	Test Track Location	Remarks
Poma-Otis	Grenoble, France	A full size test track facility with three stations based on the latest generation (simplified) of Poma 2000 technology. The system is intended for both demonstration and Poma employee movement between various facilities. Approximate cost $5 million funded by Otis.
Doppelmayr	Wolfurt, Austria	Three passenger vehicles operating 18 mph with 30 sec. headways based on their gondola detachable grip technology.
Leitner	Vipiteno, Italy	A full scale test track since 1993 consisting of 20 passenger vehicles operating at 16 mph with 30 sec. headways based on their gondola detachable grip technology (98 ft. minimum radius).
Yantrak Cable System	Carson City, Nevada	A 900 ft. (straight) long cable People Mover test track (predecessor of Otis Shuttle I system).

The Past Role of VSL

The withdrawal of VSL from the cable People Mover business was a result of its failure over the last twenty years to break into the mainstream People Mover market. It seems like a decision made totally at the wrong time by its parent company. Ironically, this decision came as the market was starting to recognize the benefits of ropeway People Mover systems. VSL introduced a rubber-tired, fixed grip, rope-driven People Mover (single- and double reversible shuttle) into the market with its 1980 installation for Circus-Circus in Las Vegas, Nevada. This was the first system of its type (not counting an experimental temporary rubber-tired funicular installation in Haifa, Israel many years ago).

VSL based its technology on a few key suppliers rather than developing in-house capabilities. Among VSL key suppliers have been Streiff (more recently Lift Engineering) for propulsion, Frey for controls, and CWA for car bodies. More recent undercarriage generations were constructed in house with assistance of local subcontractors. Figure: “Treasure Island People Mover Undercarriage Design” shows design details of the latest VSL design.

The in-house strength of VSL resided in the guideway design and implementation aspects of a project which is not typical for People Mover suppliers. VSL designed probably the most elegant People Mover guideway ever built (for the Treasure Island installation). VSL was able to combine the simplicity of ropeway shuttle technology with the elegance of monorail appearance which is very attractive to private buyers in resort environments.

VSL was solely responsible for introducing their People Mover concept in the mega-resort area of Las Vegas and Reno, the market niche it dominated for many years. Since 1980, several installations of this type have been built. Table: “Casino Operated Cable People Movers in Nevada” lists design and operational characteristics of selected People Mover installations in Nevada (all of them by VSL).

POMA Laon Experiment

Pomagalski SA, and its’ then corporate partner Creusot-Loire formed Poma 2000 in 1972 in response to a French municipal authority request for creation of a modern urban cable-propelled transit system. The year before, in 1971, Pomagalski had finalized the design of its’ sophisticated cable People Mover, partially financed by the French Transport Ministry and the General Office of Scientific and Industrial Research. Prototype tests on the 2,000 ft experimental test track near the Grenoble headquarters were completed in 1976.

Figure
Treasure Island People Mover Undercarriage Design

Note: See hard copy for this page.

Table
Casino Operated Cable People Movers in Nevada

System Characteristics	Circus-Circus People Mover (Las Vegas System I)	Circus-Circus People Mover (Las Vegas System II)	Circus-Circus People Mover (Reno System) (South and North)	Primadonna People Mover	Mirage/ Treasure Island People Mover
Horizontal Length	1,315 feet	686 feet	700 feet/460 feet	1,800 feet	1,114 feet
Radius of Turns	250 feet	120 feet	40'/400' (min/max) (South and North)	464 feet	300 feet
Maximum Angle of Curved Section	45°	45°	36°/36°	12°	24°
Track Width	11 feet	11 feet	10ft-7in/10ft-7in	5 feet	5 feet
Maximum Grade	11.8%	2%	2%/2%	10%	9.5%
Number of Vehicles	2	1	1/1	1	1
Passengers per Vehicle	50	54	50/50	60	60
Traveling Speed	950 fpm/ 1,200 fpm (max)	1,200 fpm	1,200 fpm/800 fpm	1,320 fpm	1,180 fpm
Auxiliary Drive Speed	300 fpm	300 fpm	300 fpm/300 fpm	196 fpm	N/A
Cycle Time	110 sec.	72 sec.	72 sec./66 sec.	105 sec.	108 sec.
Type Drive	SCR-controlled DC	SCR-controlled DC	SCR-controlled DC	SCR-controlled DC (South and North)	AC-DC converter
Type Controls	Remote/ Automatic	Remote/ Automatic	Remote/Automatic (South and North)	Remote/ Automatic	Remote/ Automatic
Type of Operation	Shuttle	Shuttle	Shuttle	Shuttle	Shuttle
Number of Stations	2	2	2/2	2	2
Completion Date	May '81	Feb. '86	Summer '85	Nov. '90	Sept. '93

POMA Urban Transportation Systems used to be co-owned (66%) by parent Pomagalski SA and (34%) by Societe Generale de Techniques at d'Etudes (SGTE), an

internationally recognized “think tank”. In 1984, SGTE, a subsidiary of the large construction company Spie Batignole, replaced Creusot-Loire as a partner in POMA and helped finalize engineering and development of the POMA People Mover. Pomagalski subsequently acquired 100% of the shares.

POMA’s ‘tour de force’ example of technological leadership in cable is its People Mover at Laon, France. The Laon system, in continual daily operation since its inauguration in 1989, qualifies as the world’s most advanced urban cable People Mover for several reasons. The Laon system is a cable People Mover with a detachable grip which means that a single vehicle can transfer between separate routes while passengers remain aboard. Vehicle transfer is fully automated and proven to be safe and reliable. POMA detachable grip technology also allows multiple vehicles to operate with departures every 30 seconds using a single cable and drive motor. This downtown system operating at grade, underground, and on elevated guideways works in a network with the city transit systems. POMA cable technology allows them to compete with self-propelled systems for operation of complex network routings.

However, the complexity of Poma 2000 caused that Poma has not been actively promoting this technology. Instead of, it entered into a joined venture with Otis (a supplier of several cable-driven horizontal elevators) to launch Poma-Otis Systemes de Transport in June 1996 to combine the strengths and mitigate the weaknesses of both companies. The venture was triggered by Otis’ contract for the Mystic Transportation Center in Medford (near Boston) which was the first Shuttle I Otis installation as conceived for the low cost, private market.

Mandalay Bay Doppelmayr Breakthrough

Apparently not discouraged by Soule’s experience in Paris, Doppelmayr has followed the Soule path with a somewhat similar concept People Mover design called Cable Liner. The concept of continuous flows originates from their experience in the design of continuous movement, express gondolas. Frequent service, with 30 second intervals between vehicles, makes high capacity possible. A dedicated Doppelmayr Cable Car GmbH company was formed in 1996 to develop and market their new People Mover product as a result of feasibility study results for the Austrian town of Loesung Bregenz. The test facility was built in Wolfurt, Austria by a joint development of Doppelmayr and ANL Seilbahntechnik (a Siemens division) which specializes in custom Programmable Logic Controllers (PLCs) for ropeway installations.

However, the first installation of Cable Liner is not based on the Wolfurt concept. Although it utilizes its innovative guideway design and many vehicle subsystems, it is based more on a funicular technology with a fixed grip. The Mandalay Bay Express represents a major breakthrough for Doppelmayr as it enters the People Mover business. Over 65,000 pedestrians circulate the intersection of Las Vegas Boulevard and Tropicana Avenue in Las Vegas, Nevada during peak hours. Jakes Associates, Inc., under sponsorship from Circus Circus Development, has devised a solution for capturing a big share of the intersection traffic by implementing a sophisticated and attractive elevated guideway transit system between the intersection and selected Circus Circus properties. The fully enclosed intersection transit station is integrated with

the existing overhead walkways linking all corners of the intersection at the same pedestrian transfer level. Two express trains capable of transporting 3,500 passengers per hour per direction depart from the intersection station to the Mandalay Bay Resort destination. However, only one train shuttles passengers back making stops at the Luxor and Excalibur Hotels and Casinos.

The system, supplied by Doppelmayr, will open in April 1999 only eleven months from the notice-to-proceed setting another construction record for transit projects of such magnitude. The system based on cable-propulsion introduces a prototype steel guideway design. The narrow, light, and transparent nature of the guideway, makes it not only very elegant and unobtrusive, but also cost effective.

Steel Wheel Versus Rubber Tire Approach for Cable Systems

Most cable suppliers automatically assume rubber-tired vehicles are most appropriate for People Mover applications and rush to redesign their funicular systems to accommodate guidance systems inclusive of rubber tires. It is generally not necessarily a good direction from a technical point of view (although one may argue its occasional marketing advantages).

Steel wheels would provide an equal performance in terms of vibration and ride comfort, and a better life cycle cost performance for most (if not all) applications. The cost saving could be very substantial. Jakes Associates, Inc. estimated for the Disney Westcot People Mover project (abandoned) that the saving would be close to 3 to 5% of system cost. This is one of the reasons Poma-Otis has used this approach for Mystic where the rubber tire option would easily exceed the contractual budget by far.

The steel wheel/steel rail cable pulled People Mover would be an ideal candidate for a typical airport shuttle installation where CX-100 technology is usually applied. Simple, proven guidance with quiet resilient wheels would provide equal performance at drastically lower cost. This is what Jakes Associates proposed to the Miami International Airport in 1993 to replace the aging C-100 system with a steel wheel/ steel rail cable system. The steel rails could have been placed on the top of cracked concrete guideway surface having a tolerance which is no longer acceptable for a rubber tire surface but would function perfectly for supporting steel rails. This was in response to the airport desire to evaluate a cost effective solutions.

Limitations of Cable Technology

There are many advantages and disadvantages of ropeway technologies for transit applications. Among advantages are the following features:

- No grade restrictions
- Ideal for severe weather conditions (no guideway heating needed)

- Lower life cycle costs
- High level of safety (no collision possibility)
- Simpler control system.

Among disadvantages are the following limitations:

- Distance
- Speed
- Alignment (curvature)
- Expansion
- Operation
- Switching.

In general, the more complex the configuration is used, the higher the probability that an unsuccessful design may be created (for example: the de Gaulle Airport case). However, with numerous simple applications such as the Doppelmayr installation for the Mandalay Bay project in Las Vegas, the ropeway technology is ideal and many installations can be expected in years to come.

Ropeway People Movers for Ski Resort Applications

The tremendous amount of intellectual wealth has been dedicated to the development of ropeway People Mover systems. It is actually somewhat ironic that the aerial ropeway technology, so proven and widely used in ski resorts worldwide, has been applied to People Mover applications outside ski resorts, with ski resorts basically ignoring their transit circulation benefits. Only very few ski resorts have ever considered a People Mover installation.

With the exception of the troubled Mammoth Mountain installation (not rope-propelled), other resorts have merely expressed limited interest in People Mover opportunities with Keystone Resort giving them probably the most detailed and serious chance of them all. It is primarily due to the lack of a successful demonstration in similar setting, misconception of the costs, and the existing ‘know how’ associated with the aerial applications which creates some resistance to other technologies among the operators and decision makers.