HighRoad RTS and Heavy Rail Transit Systems

PREPARED BY

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General: Heavy rail transit systems have been in use world-wide for over 110 years, offering low-speed large capacity transit for use principally in high density urban settings. At-grade tracks in dedicated rights-of-way offer relatively safe pathways, but are very expensive and divide communities. Underground tracks in subway systems provide less intrusion into heavily-populated areas, but are exceptionally costly. In contrast, dual-sided monorails are a newer type of transit which provides vehicles running on opposite sides of a single elevated guideway located above the city streets. Since right-of-way usage is minimized, system flexibility is maximized and disturbance to the community during construction is minimized. Consultants and officials who must select a locally preferred technology must make comparisons of all feasible alternative systems. As a prospective feasible alternative, the Owen Transit Group, Inc. (OTG) HighRoad Rapid Transit System (RTS) is presented in comparison with a generic type of late model heavy rail system. Data used is from openly published sources. These pages are to define some of those system distinctive features.

Performance and Speed: Both HighRoad and heavy rail systems offer 70 mph service. However, because distances required for accelerating and stopping a heavy rail system usually provides stations for passenger access at up to three mile intervals. In contrast, the HighRoad stations are located at distances of ½ to one mile, bringing station access closer to passenger origins and destinations. Where a large 10-car heavy rail train can carry as many as 1,800 passengers at a three-minute headway, resulting in capacity of 36,000 passengers per direction per hour, the HighRoad system uses one or two vehicles of 140 passengers each arriving/departing from small stations at short intervals. As brief as 15 second headway intervals can be achieved by using a patented extended dwell time procedure, resulting in as many as 67,200 passengers per hour per side with a two-vehicle consist. By comparison with heavy rail, the HighRoad RTS can exceed its capacity in extremely dense urban settings.

For intercity and commuter rail service the HighRoad Silver Bullet and HighRoad Silver Commuter are designed for speeds up to 214 mph. Maximum gradient possible with heavy rail systems is usually about 2 %, limited by horsepower and brakes. The HighRoad RTS is capable of up to 7 % grades, made possible by its high horsepower motors and its multiple braking systems.

Capital Cost: Published costs of the HighRoad RTS in the United States is in the range of $35 to $39 million per mile ($22 to 24 million per kilometer), depending on number of vehicles, stations, local costs and topography. Estimated costs include right-of way and utility relocation allowances, design fees and licenses. Heavy rail costs vary from a low of $200 million a mile ($ 120 million per kilometer) to as high as $250 million a mile ($ 155 million per kilometer), depending on terrain and stations. Based on the lower of both systems' cost ranges, the HighRoad RTS costs one-fifth as much as heavy rail while providing the same or better service.

Operating Costs: The A-C powered HighRoad RTS operating costs are estimated to be less than the heavy rail costs due to the lighter vehicle weight energy use and the automated controls. Additionally, some D-C powered heavy rail vehicles have added power costs associated with converting AC power to DC power. As a result of the lower operating costs, the HighRoad RTS can more easily cover its costs from fare box revenues and not require additional operating subsidies.

Vehicles: Heavy rail vehicles are designed primarily with steel for at-grade crash protection and derailment, or aluminum. The HighRoad RTS vehicles are designed with advanced lightweight composites and use existing, proven components for its construction. These include proven-in-service doors, air conditioning, motors, solid-state power controllers, signal controls, security systems, and pneumatic braking components. Heavy rail vehicles have been in use for many years and its components are proven in service.

Both the HighRoad RTS and heavy rail vehicles have very large panoramic windows on both sides of the vehicle, making the passenger trip more enjoyable. In emergency evacuation procedures, heavy rail passengers can step down to grade. The HighRoad RTS has doors and windows on the guideway side for passengers or rescue personnel to access the top of the guideway and vehicle in the event an evacuation is needed. This window and door arrangement also allows another vehicle to attend a stopped vehicle on the guideway and transfer personnel from one vehicle to another.

Propulsion: The HighRoad RTS system uses standard AC electric motors with digital solid-state VFD (variable frequency drive) controls to provide smooth accelerations, including short-term motor overloading, increasing horsepower for acceleration and climbing grades to double that of conventional motors. Heavy rail vehicles usually have DC electric motors and receive power from an overhead trolley wire. In some cases an at-grade third rail is used for heavy rail power instead of the usual overhead wires above the tracks. Recently some systems have been converted to use AC power.

Braking: Each HighRoad RTS vehicle uses regenerative AC motors and solid-state controls to provide 100% braking during normal operation. In addition, the HighRoad RTS vehicle has two 100% stand-by pneumatic fail-safe auxiliary friction braking systems which apply braking to a fixed braking rail on the guideway, avoiding potential loss of brakes by “heat fade”. All three systems are used to provide for emergency braking. The added braking capability of the HighRoad RTS system allows safe descent of steeper gradients. The pneumatic brake systems on the HighRoad RTS are redundant and fail-safe, so that in the event of power failure or loss of pneumatic pressure the vehicle will quickly brake to a full stop. Heavy rail braking systems usually use friction pads applied to the wheels or brake disks and are restricted to small grades.

Tracks and Guideway: There are major differences in the two systems. Heavy rail vehicles usually run on parallel sets of tracks, or use one set of tracks with passing turnouts and operator-controlled passing waits. Heavy rail wheels are steel which run on steel rails. Sound-deadening of the heavy rail system rails and support structure is difficult due to the use of flanges on the wheels which rub on track sides to keep the vehicle on the rails.

The HighRoad RTS operates on rails attached to a high-mass concrete beam and uses sound-deadening material for the “Quiet Rail” patented rail surface interface with the concrete. The HighRoad system of three-wheel connection provides a non-derailable attachment to the guideway and eliminates flange grinding with no-flange wheels. Additionally, the drive wheels and the top rail of the HighRoad RTS guideway are protected from snow and ice accumulations by the overhanging top of the guideway, and can have heat tracing wire to de-ice the rails during time of icing or snow.

Stations: The standard size for a HighRoad RTS station is 50 feet long (about 15 meters), with a typical 150 foot combined width (46 meters), determined by the standards of the National Fire Protection Association (NFPA/ANSI-130 and NFPA-101), security and personal safety requirements, and compliance with the Federal Law governing accommodations for persons with disabilities (ADA). HighRoad RTS stations are accessible from each side of the station and accordingly have two sets of stairways and elevators.

In contrast, the heavy rail stations are accessible at stations usually about ten cars long. Stations are frequently located away from roadways since boarding would interfere with traffic and make center-of-roadway boarding hazardous to the passengers. The smallest heavy rail station would be the length of the train sets up to several hundred feet long. Elevated stations are not used often because of the very high cost of elevating the two sets of tracks and platform.

The heavy rail stations at grade frequently are very expensive, usually costing $50 million or more each. Adding stations to an existing track system without interruption of service or modification of the track would be very expensive.

Power and Controls: The heavy rail system usually uses high voltage DC power for main traction, with power delivered by a suspended wire above the tracks accessed by a trolley pantograph. The HighRoad RTS uses a widely available voltage (480/277 Volt 3-phase AC) for supplying power by means of dual pantographs running on power bars located beneath the guideway top overhang. The HighRoad RTS station embodies an auxiliary power generator to maintain the station in full operation (elevator, lights, security, guideway doors) and provide partial power to the guideway power bars for safety power to the vehicles. On-board UPS (uninterrupted power source) batteries are provided in the HighRoad vehicles for continued safe operation of controls even during an extended power shut-down.

Safety: The shape of the HighRoad RTS guideway provides a wide, flat surface on the top for an emergency walkway accessible from a stopped vehicle in accordance with NFPA/ANSI-130. Additionally, this same guideway top surface allows a rail-guided emergency vehicle (such as an Emergency Medical Service or Fire Department vehicle) to quickly reach passengers in the vehicle. This vehicle can also be used to push a disabled vehicle to a nearby station or service area. The heavy rail tracks are usually accessible by means of the adjacent roadway, except when a grade separation or subway tunnel is used.

Materials used in both vehicles must comply with the Federal Transit Administration standards for fire and smoke safety criteria. Both vehicles must provide for emergency telephones for passenger use, and have emergency voice speakers for safety instructions to the passengers. The HighRoad RTS vehicle also has real-time television cameras and sound monitoring in the cabin for continuous remote monitoring by security officers. Heavy rail vehicles have operators on board.

Conclusion: Each of the two systems discussed above offer advantages to the public. The variances between systems offer officials who are charged with system selection a choice between modes (heavy rail or monorail) which offer clearly distinctive differences.

The above information was obtained from published articles and the manufacturers' documents. Specifics of OTG, Inc. products are subject to revision without notice.

