RAIL NOW

Advances in Light Rail Technology

Recent years have seen much progress in virtually every aspect of light rail and streetcar technology and performance.[1] This progress is largely as a result of advances in electronics, software and materials. It is playing a major role in making such rail systems more attractive to both users and transit operators, and it has been a major factor in the surge of expansion of existing systems and the construction of entirely new systems that has been taking place throughout much of the world during the past several decades.[2] Among these advances are (in no particular order):

reduced power consumption Lower energy use has been attained through the development of more efficient motors, better electronic controls, regenerative braking (which causes brakes to act as generators and feed power back into the system) and the use of lighter weight car bodies. This enhances the already excellent energy efficiency of light rail and thereby helps conserve power use for other applications. It also helps reduce operating costs.

faster acceleration This has been attained through improvements to the electric motors (including the development of more powerful magnetic materials) and the development of advanced electronic controls for them. The result is a faster average speed and reduced trip times.

wheel-mounted motors This is a relatively new alternative to conventional systems in which the axles are driven by motors via reduction gears and flexible couplings. It has been made possible through the development of powerful rare earth permanent magnets and advanced electronic controls. A major advantage is that the bulk of the motors and drive couplings under the vehicle floors is eliminated, thereby making possible 100 percent low floor vehicles. Another advantage is reduced torque transmission loss and thus lower power consumption. In addition, it results in both reduced maintenance costs and lower noise output.

low floors Fully low floor vehicles have been made possible by the development of wheels that are individually powered, thereby eliminating the need for bulky central motors and axles. Floor that are the same level as street curbs makes entry and exiting easier, faster and safer, especially for people with disabilities, wheelchairs, bicycles and large loads. It also reduces station dwell time, thereby contributing to faster overall speed. In addition, costs are reduced because of the elimination of the need to maintain mechanical lifts or retractable ramps.

lighter weight car bodies Aluminum alloys and composite materials can provide high strength while greatly reducing weight as compared to steel. The result is a substantial savings in energy consumption without sacrificing safety.

greater safety The already excellent safety standard of light rail is being further enhanced through the development stronger vehicles (which better protect passengers in the rare event of a collision) and the elimination of steps (through the use of low floor vehicles). Also adding to safety is the use CCTV cameras instead of mirrors and direct observation for vehicle operators to monitor the closing of doors and road traffic behind the vehicle.

traffic signal priority Low cost electronic devices allow street traffic signals to give priority to approaching rail vehicles in intersections where rail vehicles run in streets or in street medians. Signals can be set so that green lights are held longer and/or so that red lights change to green when a transit vehicle approaches. This contributes to faster overall speed.

higher average speeds Shorter average journey times are attained through faster acceleration (due to improved motors and advanced electronic controls), faster passenger entry and exit (due to low floor vehicles and external ticket machines) and priority at traffic signals. This is an important part of rider satisfaction. It also helps reduce operating costs and increase the frequency of service.

third rail power Safe third-rail power for street operation has recently become practical largely due to advances in electronics technology. This enables light rail transit vehicles to operate without overhead wires and instead obtain power from a metal strip embedded in the street in between the two rails. Only the area directly under the vehicle is energized, thus posing no danger to pedestrians. Although considerably more expensive to install that overhead wires, this can be preferable in some historical districts. Also, some cities (such as Washington D.C.) have laws that prohibit the use of overhead wires in central areas. The first installation of street level third rail was on the new light rail system in Bordeaux, France, which began operations in 2003.

alternative power Methods of powering vehicles for locations for which erecting overhead electrification is not economical or practical include diesel engines, batteries, fuel cells and flywheels. Progress has been made on all of these. Diesel is still the most practical and has recently seen much progress, including reduced fuel consumption, lower exhaust emissions, reduced noise output, faster acceleration, increased passenger capacity and simplified maintenance. For more about diesel powered light rail, please see the page *Diesel Multiple Unit*. Fuel cells could become practical in some situations within a few years. At least one company already is offering light weight transit vehicles that are powered by flywheels which are recharged during station stops. Moreover, work is also being carried out on ultra-light rail transit vehicles that are powered by solar energy.

greater passenger capacity This has been made possible by the development of longer, articulated vehicles for use in place of trains consisting of separate cars. Articulation allows vehicles to negotiate much sharper curves than could non-articulated vehicles of the same length, and it allows what would otherwise be wasted space between individual cars to be used effectively. Advantages of increased train capacity include less crowding, reduced station dwell times and greater productivity for vehicle operators.

improved articulation: Articulation has become more reliable, less costly and more attractive due to advances in vehicle structure and materials. It offers some important advantages as compared with trains made up of multiple vehicles of same length including (1) increased passenger capacity, (2) increased passenger convenience, (3) enhanced security, (4) greater ease of negotiating sharp curves (because articulated sections can be shorter than individual rail cars) and (5) greater safety. One reason that articulation is more convenient for passengers is because it allows them to easily walk to some other section of the train if desired (such as if vacant seats are available in another area, to get a good view out of the front window, etc.). One reason that safety is enhanced is because it is easy for passengers to walk through the train in the rare event of an emergency. Articulation also facilitates inspection of tickets and passes.

improved fare collection Advances in electronics and computer technology have made automatic ticket machines and other automatic payment systems easier to use, more reliable, more versatile and less expensive. The result is greater rider convenience and the elimination of collection of fares on board. Rider convenience is increased because the machines can do such things as provide change, accept credit cards and issue various types of passes (e.g., multi-ride, single-day and monthly). Service is faster because vehicle operators do not have devote time to issuing or inspecting tickets or passes.

increased security Advances in electronics and software have greatly reduced the cost and improved the efficiency of monitoring vehicles, stations and the right of way for nuisances, dangerous conditions and criminal activity.

real-time information The display of real time information for both vehicle operators and passengers is being made possible through advances in electronics, communications and computer technologies, including the availability of large, low cost LCD display panels and the transmission of information over the Internet. This allows having non-intrusive electronic displays in stations and vehicles showing such data as the next station, arrival times, times required between stations, delays, etc.

computer-friendly It is becoming increasingly practical to provide transit users with high-speed Internet access both in vehicles and in stations as a result of improvements in Wi-Fi (wireless fidelity) technology.

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[1]This is in sharp contrast to the often heard statement by opponents of light rail is "old fashioned" or obsolete. For more about this and other such misinformation about light rail, please visit the page *Light Rail Myths -- And Realities*.

[2]This surge in construction of new light rail and streetcar systems can be easily seen by glancing at the page *Rail Transit Systems in the U.S.*, which lists rail transit systems in the U.S. along with their dates of start of operation.

Home | About | Route | Help | FAQ | Glossary | Index

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