Air Suspended and LIM Propulsion Transit System and Next Generation PRT

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Abstract

The air suspended linear induction motor driven Air Linear Mover(ALM) is an Automated People Mover (APM) system that can accommodate complicated guideways.

In 2000, after the practicability evaluation with minute examinations, the system was approved to be suitable for use as a public transportation system.

This paper describes its characteristic technologies and its evaluation test result which had been discussed by the committee.[1]

And at present, one new plan is prepared for putting an advanced LIM Shuttle called “Next Generation PRT” into practical use as a new public transportation system for the next future.

Key Words: air pad, air suspension, linear induction motor (LIM)

1. Overview of the Test Vehicle

The exterior appearance is shown in Figure 1. The most important feature of ALM is that it adopts air suspended system for its suspension. Differing from the steel wheels or the rubber tires of conventional trains (including generally APM system) it has rubber called "Airpad" on the bottom of the vehicle. Its suspending mechanism is that the high speed motor mounted on the vehicle will rotate the blower, which will provide low pressure air to each airpads through the chassis, which is structured with square steel tubes, as it air pipe. Air provided to the airpads is blown down through small holes on the bottom of the airpads, that will make thin airspace between the vehicle and the track surface to lessen the resistance in running. Further, it is designed to need no complicated, costly damping devices such system used by conventional trains, because between the cabin and the chassis are fixed with rubber as a vibration isolator.

The propulsion system of the vehicle is that the LIM's mounted on the bottom of the center of the vehicle will generate propulsion by reacting against the LIM secondary side (Reaction Plate) laid down throughout the track to make the vehicle run.

As regards braking systems, regenerative/generative phase braking is used for service application, and emergency braking

system is accomplished by removing air in the airpads and letting the brake skids closely contact the track surface, which stops the vehicle by its friction. Thus the braking system itself is quite simple but is made active without fail, and it requires no braking system which has complicated mechanism with hydraulic/air compressor needed by the conventional trains.

Figure 1. Test Vehicle

2. Overview of the Test Track

A test track for ALM is shown in Figure 2.

Figure 2. Test track in Shibayama factory, Chiba Pref.

The test track is 447m in length, has curved line with minimum radius 24m, and the steepest incline 6.0%, and is available for the maximum speed of 50km/h on the straight line.

The track is equipped with reaction plates at the position corresponding to the LIM primary side, and power rail to supply DC750V, guidance rail, retention rail, loop antenna for automatic operation, signal rail, etc.

The major specifications are shown in the Table 1.

Table 1. Specifications of the test vehicle and test track

Test Vehicle	
Suspension System	Air Suspension(HOVAIR®)
Guidance System	Side Guidance by Rubber Tire
Power Distribution	DC750V
Power Collector	Side Contact, Rigid Conductor Two Lines
Propulsion System	On-Board Linear Induction Motor Primary
Switching System Operation System	On-Board and Wayside ATO: Unmanned Automatic Operation
Signaling System	ATP: Inductive Loop
Speed Control	Vector Control and Variable Exciting Current
Emergency Brake	Skid Brake
Vehicle Speed	50 km/h(system max. 60km/h)
Acceleration	0.6~ 1.0 m/s^2
Emergency Deceleration	1.0~ 2.0 m/s^2
Car Size (mm) Weight(ton) Passenger Capacity	12,800L× 2,900W× 3,600H Empty: 21.0? Full: 28.3 122 passengers/vehicle (standing)
Amenities	Heating, Ventilating and Air Conditioner Smoke Detection Emergency Intercom (Planed) Public Address (Planed) Passenger Displays (Planed) End and Side Egress (Planed)
Test Track	
Length	447 m
Minimum Horizontal Curve Radius	24 m (system min. 22.9 m)
Minimum Vertical Curve Radius	900 m (system min. 700m)
Maximum Grade	6.0 % (system max. 7.5%)

3. Evaluation Procedure

3.1 Prerequisite for Evaluation

Application of ALM for the following two systems have been examined by the Practicability Evaluation Committee.

A) On-Demand Transportation System
This system is used for a comparatively short distance as an individual transportation system at