Efforts to Increase Shinkansen Speeds

Introduction

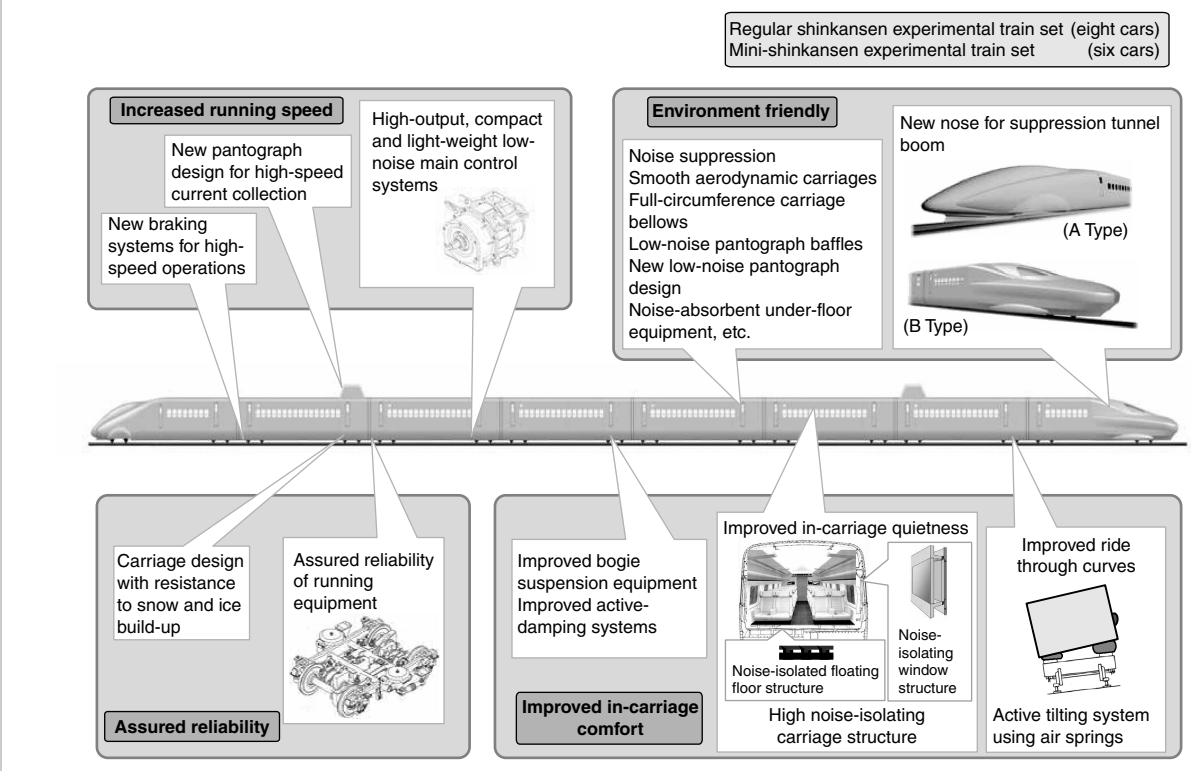
To improve its customer services even further, JR East has been making strenuous efforts to develop new technologies for increasing the speeds of its shinkansen. These developments cover a variety of technological aspects including reduced journey times resulting from higher operating speeds, higher reliability, reduced environmental impact, better ride comfort, etc., with the aim of keeping the Japanese shinkansen at the cutting edge of the world's high-speed railways. So far, each of the elements involved in developing new technologies supporting higher speeds has been examined by performing high-speed running tests using existing rolling stock such as the Series E2 and Series E3 shinkansen train sets. However, in the future, it will be necessary to perform general evaluations and assessmen of items such as carriage running stability, impact on ground infrastructure and the environment, in-carriage comfort, etc., under actual operating conditions, meaning that JR East will have to build high-speed experimental train sets with the aim of developing technologies supporting target operating speeds of 360 km/h.

Increasing Speeds

Since a variety of railway systems, such as rolling-stock design, signalling-control systems, track geometry and layout, power generation and collection, station design, etc., are closely related to increasing the speed of shinkansen, it is essential to ensure wide ranging and close cooperation between JR East's four principal research groups (Advanced Railway System Development Center, Frontier Service Development Laboratory, Safety Research Laboratory, and Technical Center) at the Research and Development Center of the JR East group and the various other company divisions.

Development of new technologies based on the assumption that operating speeds of 360 km/h can be reached requires huge technical breakthroughs and JR East has arranged the main research areas into five basic themes: high running speeds; assured reliability; high environmental compatibility; better ride comfort; other areas. Each basic theme is being tackled using analytical and simulation approaches; both scale model and full-scale testing are being used as far as

Outline of High-speed Experimental Train Sets

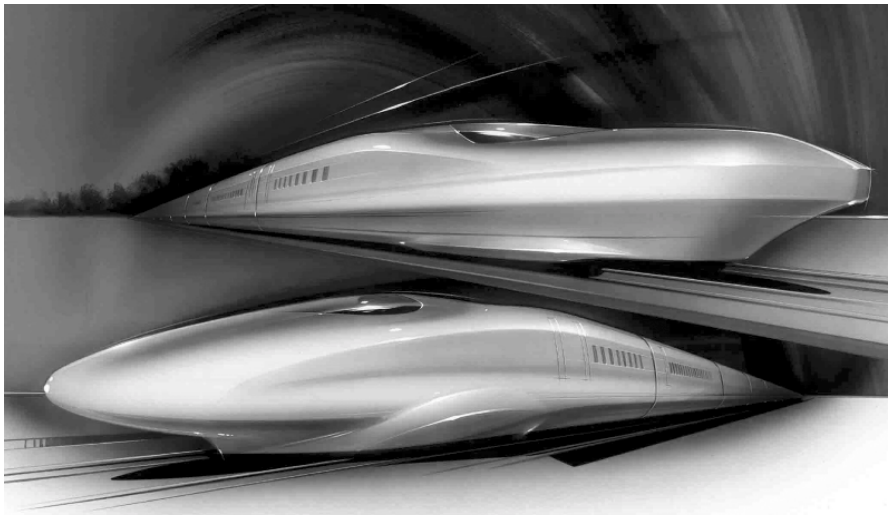


possible at facilities, like the Bogie Test Facility. In addition to examining the fruits of research, tests using JR East's latest Series E2 and Series E3 shinkansen train sets running in the speed range of 320–360 km/h are also being conducted to obtain baseline data.

Building High-speed Experimental Train Set

After confirming the validity of research methods used so far based on the results of high-speed running tests with current rolling stock, JR East decided to build experimental train sets for performing general evaluation and assessment of carriage running stability, impact on ground infrastructure and environment, in-carriage comfort, etc., under actual operating conditions. Since JR East already operates both regular shinkansen as well as the Yamagata and Akita mini-shinkansen offering through operations on conventional lines, the company has decided to build two forms of the experimental train set—the Series E954 for regular shinkansen lines, and the Series E955 for narrow-gauge mini-shinkansen lines. The former Series E954 will be an eight-car set designed for providing accurate measurements of environmental impact, main circuit structure, etc., on regular shinkansen lines, while the latter Series E955 will be a six-car set designed for making measurement on mini-shinkansen lines. Both high-speed experimental train sets will have the following features.

- High running speeds
  The experimental train sets will have a maximum speed of about 400 km/h and will use newly developed compact and high-output main circuit equipment and high-speed braking equipment.
- Reliability assurance
  To assure reliability while running at high speeds, in addition to performing thorough testing of new bogies and running gear still in development, tests will also be performed on car body designs offering better resistance to snow and ice build-up.
- Environmental friendliness
  Suppression of normal running noise requires testing of new low-noise pantograph designs and wind baffles, full-circumference inter-carriage bellows, noise-absorbing under-floor equipment designs, low-noise equipment, etc. In addition, new designs for the nose cone of lead cars will be tested to help reduce tunnel boom caused by the pressure wave propagated through the tunnel as the train enters at high speeds; carriage cross-section designs will also be tested to give passengers the most comfortable ride as far as possible.
- Higher ride comfort
  Ensuring the same ride comfort and in-carriage noise levels as passengers experience in today's shinkansen but while travelling at 360 km/h will require both improvements to both bogie suspensions and to vibration-damping devices like those used on the *Hayate* shinkansen, as well as development of new high-performance carriage designs incorporating sound and vibration barriers, breaks, etc. Another test area will be carriage tilting equipment using bogie air springs to allow passage through curves at high speeds without loss of ride comfort levels.



Artist's Impression of New Shinkansen Designs (JR East)

Outline of Ground Infrastructure Supporting Higher Speeds

The ground infrastructure on sections where the experimental train sets will run will require upgrading to permit higher operating test speeds and to measure the performance of the upgraded infrastructure and the impact of the higher speeds.

Summary

Design and manufacturing of both the Series E954 experimental train set for regular shinkansen lines and the Series E955 for mini-shinkansen are well underway with the aim of delivering the former in spring 2005 and the latter in spring 2006. Both are expected to be running tests by FY2007 and there are high expectations that the collected data will facilitate speed increases for all JR East's future shinkansen services. ■

Acknowledgement

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