What Can We Do to Develop Railway Technologies in Asia? - Railway Technical Discussion at RTRI on October 25, 2012

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The Railway Technical Research Institute (RTRI) has a rich history. Prior to its incorporation in 1986, it was the research arm of Japanese National Railways (JNR) during which time it created a new transportation system, named Shinkansen, in 1964. This was the first system of its kind in the world, designed to transport a huge, rapidly increasing number of passengers during a period of high economic growth and steadily increasing population after World War II. As RTRI is located at the birthplace of Shinkansen, RTRI's address was renamed Hikari-cho after "Hikari," the name of the first Shinkansen trains. Hikari means "shine" or "expectation" in the Japanese language indicating the wish for a train running at high speed like light to bring us hope for the future after the war. Since the introduction of Shinkansen on the revenue lines of Japanese National Railways, seven further types of Shinkansen rolling stock have been introduced by old JNR and the current Japan Railways to provide our customers with easier and more comfortable high-speed rail transportation services between urban cities. Since RTRI developed the first type of Shinkansen, RTRI has been leading the research projects on the improvement of the Shinkansen high-speed rail systems and assisting other Japan Railways companies with the application of the fruits to Shinkansen operations. For the last 30 years in particular, after TGV was developed by French National Railways, competition has been tense in introducing the most well-known two systems in the world, Shinkansen and TGV, into countries where no such a system has been implemented. Eventually, Shinkansen was delivered to Taiwan while TGV was successfully introduced in Korea. Three high-speed rail systems were also introduced in China from Japan Railways, French National Railways and German Railways to develop high-speed rail networks at a service speed over 200 km/h in the country. By the turn of the century, most of the engineers in railroad technical fields were caught up in trying to increase train service speed and spread high-speed rail networks across the world. In accordance with such trends, we have been developing technologies specific to high-speed rail. However, the global economic recession originating from the US in 2008 has unfortunately depressed the enthusiasm and passion to introduce high-speed rail networks in countries desiring high-speed rail transportation. There are still a number of plans to build up such rail systems around the world even though they are not necessarily financially guaranteed. But, the goals to develop railway transportation systems are no longer focused solely on high-speed rail development.

Another major effect to consider is the changing demographics in most countries, including Japan where we have started to see an aged society with decreasing population and a reduction in the number of young people. This has caused mass transportation service industries to lose customers and has led to some questioning whether such transportation systems are still suitable for Japan in the future. Technologies for conventional railway systems enabled the invention of the Shinkansen high-speed rail system and have been applied to its operation even after the Shinkansen system was installed. Thus, all fundamental elements of railway technologies, regardless of high-speed operation or not, have originated from conventional railway systems. Indeed, improvement of conventional local lines in depopulated provinces in Japan is one of the research and development targets for Japan Railways. Thus, it might be appropriate to consider the original motivation for high-speed rail development and find other goals to direct railway system development in situations where primary high-speed rail systems have been established and commonly used in now mature or aged, developed countries. This thought process led to the desire to understand the circumstances experienced in other countries where cultures and histories are unlike those in Japan but where situations are similar to those in Japan 50 years ago when Shinkansen was installed and while we were struggling to establish such a high-speed rail system after we decided to develop it. Given our strong interest in understanding what some Asian countries lack, need, want and expect in railway operations, RTRI organized an international meeting not just to show topics but to drill down on technical issues in our respective railway operations. The State Railway of Thailand, Taiwan Railway Administration and Vietnamese National Railways sent seven engineers to the meeting in total. We were together at the RTRI Headquarters for a day in October 2012 to discuss such topics, amounting to 11 in number, brought by the speakers from the railroad companies. The papers covered most of the railway technical fields, including operation, rolling stock, power and facilities. We discussed each topic for 30 minutes after a five minute presentation was completed each time. Thus, we were able to avoid one-way presentations from speakers to the audience as is often the case at international conferences, especially where non-native English speakers are participating. 150 engineers and scientists in total joined the meeting from RTRI to activate the discussion and respond to the speakers. They gave their own knowledge and experience obtained through research at RTRI to contribute to the goal of the meeting to find opportunities to develop practical solutions.

As an example, one of the speakers showed the current situation where railway facilities are not well maintained. The complicated maintenance standard system originating from three different countries conflicts with different designs that the workers have to use to maintain their civil engineering facilities. RTRI engineers stressed in this case that the most important point is not to introduce sophisticated new technologies calling for large-scale budgets to fully repair damaged elements of the facilities quickly, but to observe the progress with the damage at regular intervals and eliminate malfunctions on a step by step basis.

Another topic discussed concerned the preparation to accommodate a large number of passengers due the improvement of rail transportation systems in urban areas. The railway has already installed prepaid fare ticket systems to automatically collect fares from customers. However, a few different types of systems have been introduced without the capability for expansion expected in the future. The engineers from RTRI suggested that a good opportunity to unite different systems should be when the current systems are renewed due to the expiration of the life. It is not practical to combine all the current systems into one common system for customer convenience. However, now is a good time to start preparation for successful system unification, which normally takes a long time for careful planning for the future. This is not necessarily technical advice but clearly indicates how important it is to be prepared for such a large-scale system change or immediate increases in rail capacities.

Another rail operator has experienced some vehicles getting easily derailed right after their tires are carefully inspected and repaired. The vehicles come off the rails just on the way from a rolling stock workshop with their conditions properly tuned up according to their standards. They feel the phenomenon is peculiar because the rolling stock should be in the best condition right after being subjected to full inspection and maintenance services. RTRI researchers suggested that not roughness but freshness of the surface of the metal tires resulting from machining can increase the friction coefficient and induce the tire to climb up the rail. Thus, the machined tires should be protected with grease to avoid such friction. This is not to reduce the noise coming from the interface between tire and rail but to prevent the fresh tire surface from direct contact with the rail surface. The suggestions given by RTRI researchers were of practical use and significance but not of an inspiring nature. This was unexpected by those who brought these topics to the meeting. They supposed that, because RTRI is known for developing leading-edge technologies, the RTRI researchers would display that high-level knowledge at the discussion. The researchers, however, were pragmatic and displayed no unnecessarily glamorous technological solutions. RTRI thought that the engineers from the rail operators should learn fundamental technical solutions and follow logical technical steps. There are no miracle stories or magic procedures, especially as railway systems have been organized by combining independent technologies in various kinds of fields.

Thus, our discussions eventually provided a common realization that there is a difference between what the engineers from the railroad companies expect and how RTRI researchers have come to feel or think about issues. Then, we recognized that direct discussions can suggest goals that are different to the trend of trying to increase train service speed and develop high-speed train networks. This experience at the meeting awakened and stimulated the participants to start thinking about where they should go under the circumstances where the global economy is not stable and populations begin shrinking in already-developed countries. The tips found through the discussions are priceless possessions for the engineers from the railroad companies to assist themselves in overcoming their technical issues and also for RTRI researchers to help themselves in finding a direction in which they should go in the future.

Fig. 1 Mr. Kumagai, Vice President of RTRI, is giving a welcome speech to receive all speakers from railroad companies in Asia and researchers from RTRI to encourage them to achieve constructive and practical discussions at the RTRI Discussion

Fig. 2 All the speakers from railroad companies in Asia and researchers from RTRI joining the meeting are together to remember how they enjoyed the discussion at this opportunity