Heritage of Kaya Railway and Japanese Wooden Model Steam Locomotive

Ichiro Tsutsumi and Sohei Shiroshita

Introduction

This article describes the maintenance of preserved rolling stock at Kaya Railway technology with emphasis on skills transfer. The Railway Preservation Society of Japan was established 11 years ago with Kaya Railway at the core of 24 organized members and eight supporting members. Kaya Railway is famous for owning steam locomotive No. 2 built by Robert Stephenson & Co. in 1873 for the opening of the Osaka–Kobe section of the Japanese government railways in May 1874. Kaya Railway bought this locomotive in 1926 from Hikami Railway in Shimane Prefecture and kept it in use until 1956.

Outline of Kaya Railway Preserved Rolling Stock

Kaya Railway is an old private railway in Kyoto Prefecture and is now a famous heritage railway. It was established with funds of about ¥300,000 in 1925 by a group of local silk textile manufacturers. The company started railway operations on a 3'6" gauge line between Tango-yamada and Kaya (5.7 km) in 1926, using a steam locomotive. In 1939, the line was being used to carry nickel ore from a mine to a factory on Miyazu Bay. After WWII, the railway changed to local passenger transport.

Increasing private car ownership in the 1970s saw the line fall into difficulties and the railway was closed in May 1985. Kaya Railway ownership changed to Kaya Kosan in December 1985 and continued operating as a general contractor as well as bus and sightseeing business based on some preserved rolling stock. The line's history is summarized in Table 1. Even while operating as a private passenger railway after WWII, the line's owners had already embarked on some early rolling stock preservation after a visiting member of the Imperial family commented on steam locomotive No. 2. As a result by 1996, the Kaya Railway had 23 pieces of preserved rolling stock (Table 2). The oldest is obviously steam locomotive No. 2 but there are also three wooden passenger carriages dating from the 1890s, one of which is German built.

In May 2000, the Japan Industrial Archaeology Society designated steam locomotive No. 2, five passenger carriages (*Habu* 3, *Ha* 21, *Fuha* 3, *Ha* 4995, and *Ha* 10) and a freight wagon (*Wabu* 3) as valuable industrial heritage items.

Table 1 Outline History of Kaya Railway

Date	Event
April 1925	Establishment of Kaya Railway Company with capitalization of ¥300,000
December 1926	Start of railway transport between Tango-yamada and Kaya
September 1934	Start of bus transport business
August 1939	Start of nickel ore transport
June 1944	Suspension of bus transport
May 1952	Restart of bus transport
January 1956	Start of steam locomotive preservation and exhibition
April 1959	Start of general contractor business
May 1985	Withdrawal from railway transport
July 1995	Temporary closure of Kaya Railway
November 1996	Reopening of Kaya Railway

Table 2 Rolling Stock Preserved at Kaya Railway

Type	Number	Year/Builder
Steam Locomotives	No. 2	1873/Robert Stephenson & Co.
	No. 4	1922/Kawasaki Zosensho
	1261	1923/Nippon Sharyo Seizo
	C57189	1946/Mitsubishi Heavy Industries
	C58390	1946/Kisha Seizo Kaisha
Diesel Locomotives	DB201	1953/Mori Seisakusho
	DC351	1956/Kisha Seizo Kaisha
	DB202	1963/Hitachi Seisakusho
Diesel Railcars	*Kiha* 101	1936/Nippon Sharyo Seizo
	Kiha 51	1936/Nippon Sharyo Seizo
	Kiha 083	1951/JNR Naebo Works
	Kiha 1018	1956/Teikoku Sharyo Seizo
Electric Railcars	*Moha* 1202	1933/Tenngajaya Works of Nankai Electric Railway
Passenger Carriages	*Habu* 3	1889/Van der Ziepen, Germany
	Ha 21	1893/Government railways Shimbashi Works
	Ha 4995	1893/Government railways Shimbashi Works
	Fuha 3	1916/Nagoya Dennsha Seisakusho
	Ha 10	1926/Umebachi Tekkosho
	Saha 3104	1925/Fujinagata Zosensho
Freight Wagons	*Wabu* 3	1926/Umebachi Tekkosho
	Ki 165	1938/Tsuchizaki Works of Ministry of Railways
	Yo 2047	1937/Kisha Seizo Kaisha
Diesel Track Maintenance Car	TMC100BS	1961/Fuji Heavy Industries

Kaya Railway No. 2 locomotive built by Robert Stephenson & Co. in 1873 (Koya Kosan)

Ha 21 Passenger car under restoration (I. Tsutsumi)

Maintenance and Repair of Preserved Rolling Stock

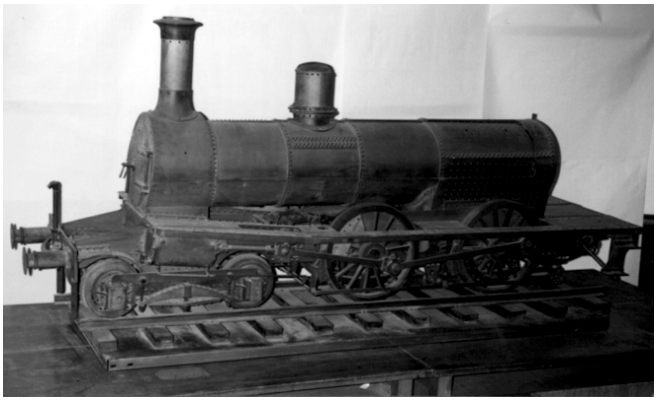
Maintenance and repair of preserved rolling stock requires various high-level skills and this section describes some examples of passenger carriage maintenance and repair as well as transfer of skills to the next generation.

Types of carriage wear

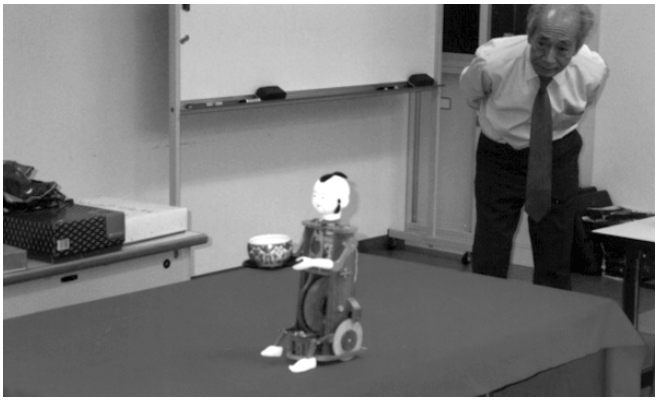
Early passenger carriages are composed of a body, roof, underframe and running gear. The body and roof are usually wood but the underframe and running gear are steel.

Forces acting on the running wooden body include its own weight as well as tension, compression, bending moment, torsional moment and their interactions. All these forces cause deformation and deterioration. In addition, wood deteriorates naturally over time under the action of water, heat, ultraviolet light, insect attack, etc. Deformation causes warping and sagging of parts like the roof stringers that can only be repaired by disassembly, checking, renewal and reconstruction. To ensure that the reconstruction is true, horizontal and vertical reference standards must be fixed external to the underframe.

The underframe is constructed of centre beams, side beams, cross members and end beams connected by riveted or bolted gusset plates. Although members and



Model wooden steam locomotive in Kyoto University Museum (S. Shiroshita)



Chakumi-ningyo tea-serving doll (H. Harumitsu)

beams are made of rigid structural steel they can sometimes sag or warp. In this case, they are restored to their original shape by applying counterforce or moments to curved or warped members Early running gear is composed of two wheel sets, axle boxes, springs, etc. The most important parts are the wheels, axles and bearings. When the wheel or tyre is excessively worn through long running, it must be reprofiled on a wheel lathe.

Skills transfer

Maintaining and repairing early carriages requires knowledge of old skills that have been learned through long experience. When the first government railways' workshop was opened in the yard of Osaka Station in May 1877, the first students studied railway and mechanical engineering, technical drawing, and other fundamental subjects like woodworking, metalworking, etc.

So how can these old and in many cases lost skills be learned by a new generation of restorers? There is no simple answer other than on-the-job training learning from a master. At Kaya Railway, a trainer with years of experience in carriage restoration takes 2 years to teach a young apprentice the necessary skills for repairing a wooden two-axle passenger carriage like the *Ha* 21 shown opposite.

1890s wooden model steam locomotive

Kyoto University Museum has a preserved Meiji-period (1867–1912) wooden model of a 4-4-0 tender locomotive that was probably used to teach locomotive and mechanical engineering students. It is a very important industrial heritage for mechanical engineering.

The model is 2.2-m long, 0.6-m wide and 1.0-m high and meticulously replicates each part of a real locomotive in every detail with great skills. The curved pipes were cut from timber and shaped with files and scrapers. The driving wheels, cylinders, rods and other parts were probably made by the same method.

This high-level woodworking skill originates from the famous *karakuri* automata of the Edo period (1603–1868), the most famous of which is the *chakumi-ningyo* (tea-serving doll) shown in the photograph. These dolls have many delicate and precision parts cut and polished with flax (*Linum usitatissimum*) from thin wooden boards. Even the grain of the wooden driving gears is radially arranged to provide equal strength in all directions. In Japan, we call artisans of this level *takumi*. Trainers at Kaya Railway have the same skill levels as these old takumi from the Edo period. ■

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Further Reading

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Ichiro Tsutsumi

Mr Tsutsumi is Senior Researcher at Institute of Vocational Training, Polytechnic University. After receiving masters degree in engineering from the Chuo University graduate school in 1974, he worked as researcher and instructor at the various institutions. He is the author of *Railways—Symbols of Japan's Modernization* and *History of Industrial Technology*.

Sohei Shiroshita

Dr Shiroshita is Associate Professor at the Kyoto University Museum of the Kyoto University. After receiving masters degree in engineering from the Graduate school of Osaka City University in 1969, he worked as an associate researcher of the Kyoto University.