

Development of MR8040X and MR7000X for India

IWANAMI Shigeru

1 Introduction

KYB-Conmat Pvt. Ltd. (hereinafter referred to as “KCPL”) (Photo 1) has been manufacturing and selling concrete mixer trucks (hereinafter referred to as “mixer trucks”) with 6 m³ load since October 2013. In the Indian market, needs for large drums with 7 - 8 m³ load and above have been gradually increasing. Our competitors offer large-scale truck product lineups, and they have been exhibiting and promoting large-scale mixer trucks in domestic exhibitions in India. KCPL has also developed 7 - 8 m³ mixer trucks in order to add them to the product lineup and lead to sales expansion. These are the newly developed models: 8 m³ mixer truck “MR8040X” and 7 m³ mixer truck “MR7000X”.



Photo 1 KYB-Conmat Pvt. Ltd.

2 Mixer Truck Configuration and Specifications

Specifications of MR8040X and MR7000X (Photo 2) are as shown in Table 1. These are additions to the lineup of MR6010X, which had already been released, but they were newly developed by changing the drum size, main frame, fastening structure, water tank, etc.

The outer diameter of the center shell of MR8040X and MR7000X drums was not changed from MR6010X. The drum was extended in the front-back direction of the vehicle to secure the required load. We aimed to standardize drum components other than the center shell

by employing the specifications that satisfy the discharge performance, load performance, mixing performance, stirring performance, etc. (Fig. 1).

In addition, by extending the center shell and standardizing the mixer frame, we were able to drastically reduce the development period.



Photo 2 MR8040X

Table 1 Specification table

	MR6010X	MR7000X	MR8040X
Total drum capacity	11.9 m ³	12.5 m ³	14.4 m ³
Ready-Mixed concrete load capacity	6 m ³	7 m ³	8 m ³
Drum rotation speed	1-15 rpm		
Blade	Two-spiral form, Cross-section C-type, with bead		
Seal pipe	None, open hopper		
Mixer frame	Front frame: U bolted		U bolted
	Roller frame: Welded structure		
Drive system	Sub engine		
	P.T.O. (drive shaft)		
Hydraulic pump, motor	Utilizing motor swash plate pump, inclined motor		
Oil cooler	Yes		
Water pump	Volute water pump		
Water tank	450 L	450 L	600 L
Chute	Removable sub chute		
Operation lever	One location on the right		

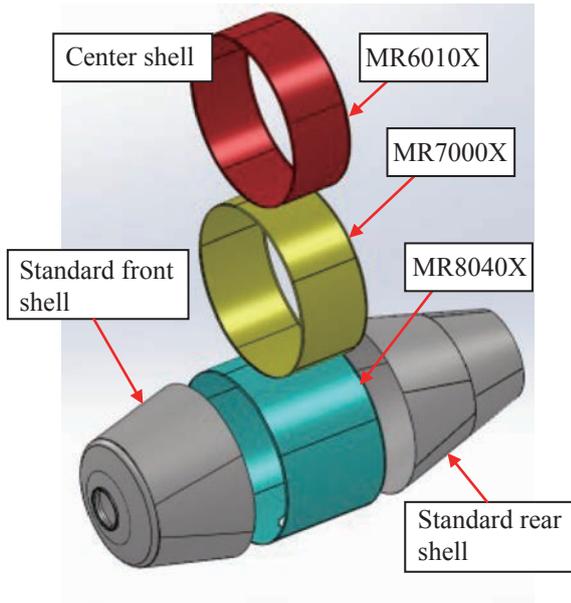


Fig. 1 Standardization of drum components

3 Frame Development

3.1 Frame structure

The MR6010X rear pedestal is welded and integrated (Fig. 2), and the chassis frame and the mounted feature are fastened with bolts (Fig. 3). The rear pedestal assembly width is fixed by welding, and we manufacture two types of rear pedestals depending on the chassis frame assembly width due to the fact that the mounted chassis frame assembly width differs for each chassis manufacturer. With MR8040X, we changed the welded structure to a bolted structure (Fig. 4) in order to standardize the fixture method of different chassis types. We have also divided the mounted feature, which used to be one component, into three components, including the front pedestal, rear pedestal, and long member (Fig. 5). With this structural change, the front pedestal and rear pedestal were made standard, and we reduced the number of special components used to fasten each chassis frame by changing the long member assembly width according to the chassis assembly width. Since MR6010X uses a welded structure, we will divide the mounted feature in the same manner as MR8040X and change it to a bolted structure in the future.

In addition, some of the chassis distributed in the Indian market have less strength in chassis frame compared to chassis distributed in Japan. Weaker chassis frame has a greater impact on a mixer frame when wet concrete is loaded and during traveling, etc. In order to also respond to such chassis, we have reinforced the frame by installing cross bars (Fig. 5) on long members. We have enhanced the rigidity of the fastening performance with the chassis frame by increasing the fastening locations as shown in Fig. 3.

3.2 Stress evaluation

Normally, development in Japan involves the design, prototype, and testing conducted within Japan. However,

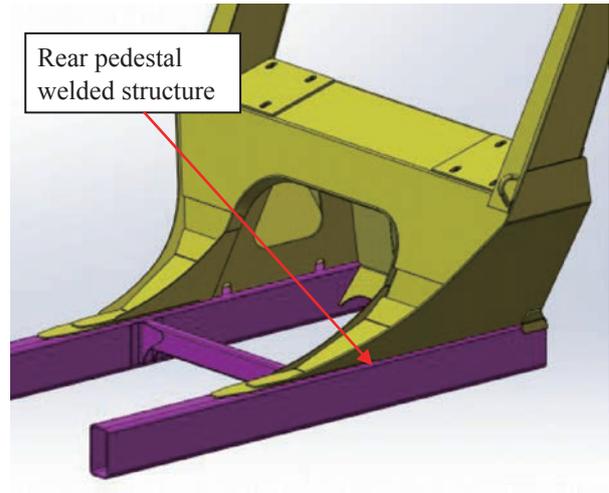


Fig. 2 MR6010X rear pedestal welded structure

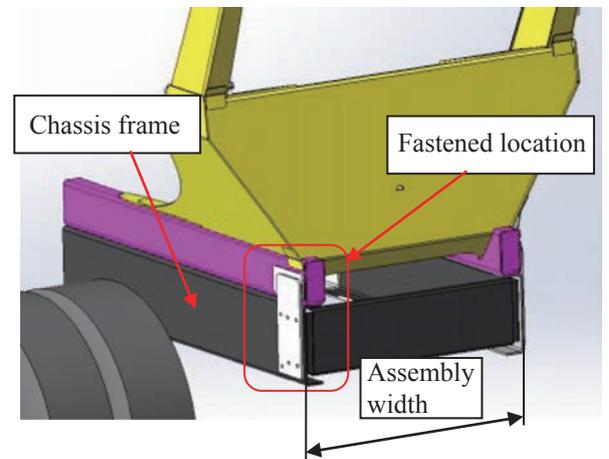


Fig. 3 Fastened locations of chassis frame

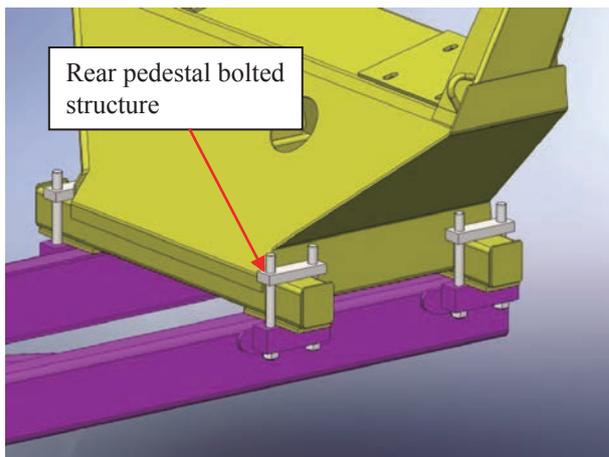


Fig. 4 MR8040X rear pedestal bolted structure

for MR8040X, the basic design formulation and FEM structure analysis (Fig. 6) were promoted in Japan, and prototypes were made in KCPL. We conducted real unit tests in India using prototypes with mounted features. This was due to the fact that we needed to conduct tests suitable for the local situation and conduct a performance evaluation because the environments, such as the road

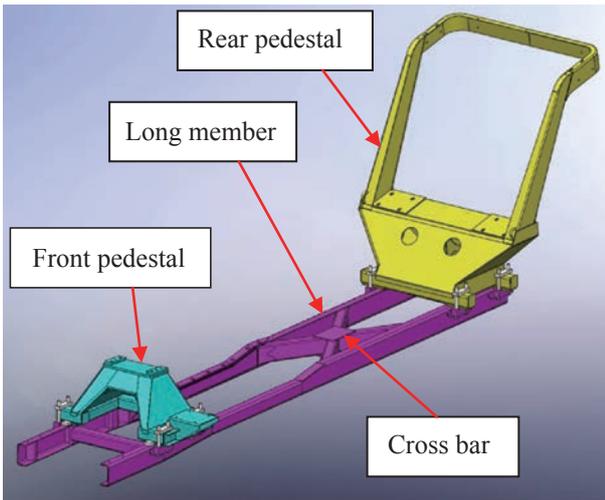


Fig. 5 Mounted feature divided into three components



Photo 4 Speed bump

condition and plants that inject Ready-Mixed concrete are different from Japan (Photo 3).

Road conditions in India are more severe than Japan, and there are also a number of speed bumps (Photo 4), which are not common on regular roads in Japan.

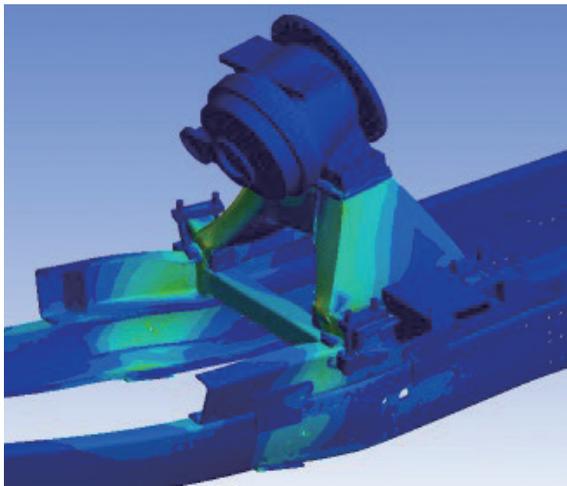


Fig. 6 FEM structural analysis



Photo 3 Ready-Mixed concrete plant

4 Drive Method

Mixer trucks in India have a small engine output of approximately 180PS, so MR6010X obtains the power for the hydraulic pump for drum rotation and water pump from the sub-engine (Fig.7) for the drum, which is installed on the mounted feature side. However, chassis of various European truck manufacturers, which have been entering the Indian market in the last few years, have great engine output. They often utilize the P.T.O.
Note 1) drive method. On a global standard, the P.T.O. drive method is the mainstream method and is expected to have more demand in India in the future. Due to this, we have utilized the P.T.O. method for MR8040X and MR7000X (Fig. 8). Considering this background, we have also added the P.T.O. drive method to the MR6010X lineup, allowing us to offer products that meet the needs of customers.

Note 1) P.T.O. (Abbreviation of "Power take off"). Equipment used to extract power from the engine.

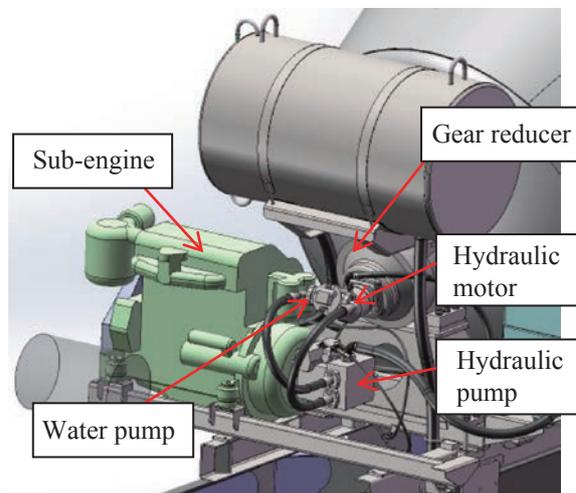


Fig. 7 Sub-engine drive

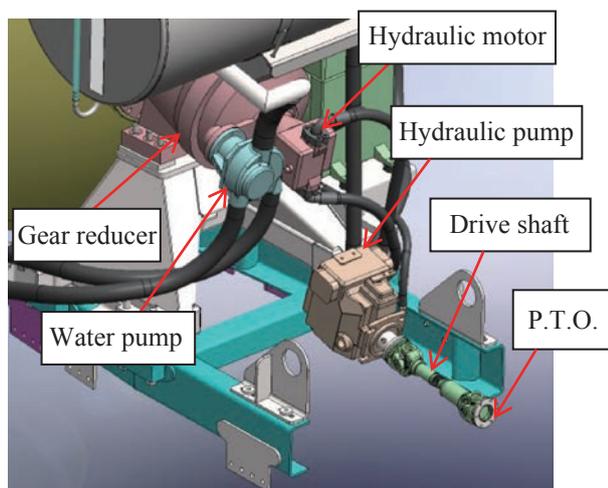


Fig. 8 P.T.O. drive

5 Performance Evaluation

5.1 Drum performance

In terms of drum performance, we check the load performance, mixing performance, stirring performance, and discharge performance. The test result value satisfied the maximum load requirement with both MR7000X (7 m³) and MR8040X (8 m³). In terms of the mixing performance, we determine if the slump value^{Note 2)} changes between the time Ready-Mixed concrete is charged and is discharged. In the stirring performance evaluation, we sample Ready-Mixed concrete in the middle of the discharge process in the same manner as the mixing performance evaluation, and we evaluate the aggregate distribution amount. Aggregates must be

evenly mixed in the beginning through the end of discharge. All of the tests satisfied the evaluation criteria. Finally, the discharge performance is evaluated by counting the rotation number required to discharge 1 m³ for each slump. Discharging more Ready-Mixed concrete with fewer rotations is preferred.

The great discharge performance is one of the characteristics of KYB drums. They can discharge Ready-Mixed concrete faster than standard mixer trucks in India.

Note 2) A value that represents the hardness of wet concrete.

The smaller the value is, the harder it is.

5.2 Hydraulic equipment durability

We measured the pump pressure for a mixer truck to complete one cycle from Ready-Mixed concrete in charge to discharge and cleaning. We conducted a bench durability test based on the measurement results. The test proved that the hydraulic pump and hydraulic motor of MR8040X and MR7000X possess sufficient durability even in usage conditions in India.

6 In Closing

The basic structures of MR8040X and MR7000X were designed based on Japanese specifications, but local investigations have been gradually revealing unique usage of trucks in India. In the future, KCPL and the Special Purpose Vehicles Div. hope to work together and promote product improvement to offer products that respond to the needs of customers in India as well as surrounding areas that receive exported trucks from India.

Finally, I would like to express my sincere gratitude for everyone who has cooperated with this development.

Author



IWANAMI Shigeru

Joined the company in 2013.
Engineering Dept., Kumagaya
Plant, Special Purpose Vehicles Div.
Engaged in designing mounted mixer
feature and development design.