

Final Assembly of LRV in United States

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1. Introduction

Final Assembly (FA) of the Light Rail Vehicle (LRV) for Dallas Area Rapid Transit (DART) is now being carried out in the northern part of Dallas, TX, by American employees.

DART has 95 Kinkisharyo LRVs and the cars being assembled now are 20 carsets of the 4th order. 10 years ago, FA for the first order was carried out in Dallas, but FA for the 2nd and 3rd orders was done at the facility of Adtranz (Bombardier at present) in Elmira, NY. For this 4th order car, FA activity is being done in Dallas again. Here in after, FA activity in U.S. is introduced on the basis of DART FA.

2. Set up of FA facility

There are two ways to set up a FA facility. One is to consign a company who has a resource to build Railway Vehicles. And other is to set up a factory by ourselves and build the car.

This time, we chose to set up facility by ourselves. Set up of the facility was proceeded by members of Kinkisharyo International, L.L.C. (KI) Hudson Bergen Maintenance Division (HBM) and the staff who has 3 years experience of VTA FA in Mare Island, CA. As shown in the FA layout figure, a semi-completed car from Japan is carried in from east side of the building and a completed car is delivered from West side of the building.

The place where we set up the factory is the same place where we did FA ten years ago, but we had to install an over head crane, a water test pit and a maintain floor.

In order to set up a new FA factory, there are many subjects to consider, but what we have to solve first is how to move the carbody shell. At VTA FA site, all the semi-completed car body, truck frames could be stored in the building, and the car bodies were moved with dolly and fork truck. This time, there is no space to store pre-production car shells, and they are stored outside of the building. This means we have to have the way to move the car from the outside to inside of the building. And also move the car to arrange car location. With regard to car movement, we decided to use a shuttle lift which is used to move leisure boat at port.

Car movement in the building, trucking and articulation work is done by using two 15ton overhead cranes which are newly installed. In addition, water test equipment, pit, weighing scale, scaffolding for roof work and truck assembling stand were prepared. The factory which we rent this time is long enough to build straight line from articulation, function test and shipping preparation.

The manufacturing process is as follows: the semi-completed car shell is brought into the building and placed in the production stage for Roof, Interior and Under

floor. Once the car is placed to the stage, the car will not move until the articulation process. Truck assembling is done simultaneously, and then the carbody shell and truck are assembled.

Another subject is safety related matters which is under the supervision of OSHA (Occupational Safety & Health Administration). We have to pay attentions to the laws and rules which are sometimes different by State. Besides scaffolding, safety harness, we have to prepare caution labels such as "Watch your step". The landlord requirements sometimes affect indispensable items in the car production. If the contract prohibits digging a pit, raised rail is to be set up to get under floor accessibility.

On another topic, drainage from water test equipment, use of paint and solvent are to be discussed. At the FA site in Mare Island, CA, we set up a high stand for under floor equipment installation. At that time, we had to prepare a document which is certified by a civil engineer about the strength of the stand. Because of the characteristic of the region which faces the possibility of a big earthquake. And also the security issue has to be considered.

3. Human resources

Regarding the employee who works at FA, in general, KI personnel work is overlooked by managers and general foremen, and the workers are employed through an agent. Some people have the experience of building train, but in most cases, they have no experience. And there are not so many people that have the experience of assembling something with an engineering drawing. In the United States, some people learn maintenance, test and inspection skills in the military. These people have good skill to do work following detailed instructions. However, building an LRV needs some experience to judge "criteria" which is difficult to express numerically. Of course, DIY is very popular in U.S. and we can find a personnel familiarized with KAIZEN, but the previously mentioned problem makes it hard to find suitable personnel. For this previous project, in order to complement such lack of experience especially in interior work and wiring work, KSJ dispatched job instructors for several month to train locally hired people.

This time, the worker who worked for VTA FA continuously worked with DART FA personnel, and they became the leaders of the production group, and could train new people without the need for an instructor from Japan.

4. FA operation

FA organization consists of: production team, production support team and QA team. Production support team takes charge of material control, QA team takes charge

of test and inspection. In this DART FA, key personnel involved is the same staff of VTA FA, so we followed the same rules about material control and production schedule management. And we introduced MP2 system which is used in HBM, for data management.

1) Production / Material Control

For production work, every work (HVAC installation, Passenger seat installation etc.) has a code (job code) and a bill of material for each code (kit sheet) is prepared. Production support team prepares material as a kit in order to deliver required material to production team in time. If a defective part is found during production or test, a Non Conformance Report (NCR) is prepared to obtain a replacement. The NCR is used for inventory control, track history and cost.

Car production is performed under production schedule and the completion of work is informed to QA, and QA will to internal inspection. Water test of under floor equipment and hi-pot test will be performed before articulation.

2) Function test and shipping

After trucking, the bellows water test is performed to check water leakage. And after this test, articulation interior is assembled. Whole write up items through internal inspection are closed, the car is turned over to the test team. Function test is performed by the following test procedure. The test starts from the light fixtures, air conditioner, doors and brakes etc. There are many items to be checked and some tests are carried out in cooperation with the sub vendors. After passing the final inspection, the car will be delivered to the customer.

The transportation from FA to the DART facility, the railroad and the sidetrack connected to the FA site is used. In the case of DART LRV, total length of the car is about 28 meters, and a 90 feet flat bed trailer is prepared for this transportation. 8 lifting jacks are used to lift the whole LRV to load onto the flatbed. In the VTA project, we used a trailer and delivered the car using the highway.

5. Conclusion

Final assembly in U.S. was started with the Boston MBTA project, and we accumulated knowledge and experience through other projects, such as DART, NJT and VTA. For the forthcoming project, we have to start up a new FA site simultaneously, and it means we have to divide the resource to multiple places. "Succession of knowledge and skill" is not only a problem for Japan, but for FA site. We have to face this subject without delay.