Complete Knock Down (CKD) System for Rail Vehicle Construction

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Cars are produced all over the world. The well-known car manufacturers assemble cars in different countries. Sometimes the necessary parts for the cars are shipped overseas from suppliers to the plants. Complete knock down for Quick Assembly.
Main advantage of CKD is the avoidance of high import duties on finished products (CBUs “Completely Built Units”). Non-European countries impose some duties between 30-300% of the value to protect local industry. According to CDK-principle duties of only 25% of the goods value will be charged.

A major disadvantage - parts must be packaged individually or in groups and be sent. Defective, damaged or lost goods may delay the manufacturing process.
Rail

* Bombardier ships incomplete cars from its plant in Quebec to Plattsburgh, New York and Vermont facilities for final assembly. These are to meet US "buy American" policies for public transit agencies and tariffs.
* Kawasaki has an assembly plant in Yonkers, New York that completes final assembly of cars using bodies shipped from Kobe, Japan.
Bombardier’s AVENTRA – An example of CKD
The ‘Complete Knock Down’ construction method used for aluminium carbodies manufactured by Bombardier Transportation in the UK allows highly efficient vehicle assembly.
An exploded view of the basic components of a CKD

Fig 1 Components of a ‘Complete Knock Down’ (CKD) vehicle
Since the carbody plays an important part in the structural integrity and crashworthiness of a rail vehicle, this manufacturing method leads to a requirement to understand the mechanical behaviour of the parent metal and also of the welded and bolted joints.

Various techniques are available for welding and bolting carbody structures to form a shell. Currently the most widely used welding techniques for rail applications are MIG, Twin Wire MIG and Friction Stir Welding (FSW). Each offers various performance and commercial advantages and comparative studies are being undertaken to evaluate these.
A current vehicle floor structure post welding, prior to final assembly.
The bolted joints evaluated in this study are Huckbolt™ connections, since these are used for current vehicle manufacture, although other bolting methods are available and could be evaluated using a similar method.
Quick Assembly of an Electrostar
10 hour assembly
Most of the work is done away from the production line
Extrusions delivered in fully machined kit form
First step in the process is to create all the major sub-assemblies such as the floor and underframe structure.
Floor planks and sole bars are set-up in specially designed jigs where they are automatically welded.
Stiffeners are manually welded to the underframe structure
Prefabricated drag box assembly is lifted into place and bolted to the completed structure
The roof planks are set-up in the jig
and welded to form the finished structure
The body side sub-assemblies are fabricated (everything delivered in kit form)
The completed underframe, roof and body side sections are then transported to the paint shop.
Underframe is attached to a manipulator and inverted for the fitting of pipework (the roof is also inverted)
Fitting of cable trunking and other equipment
Conventionally, this work would have to be done overhead
Body sides fitted out and insulation added
Fitting of interior trim panels
Throughput for roof, underframe and body side stages is balanced so that each sub-assembly is available when required.
In parallel, the cab and end modules are fully fitted out
Body side are brought to the underframe and fitted with temporary restraining bolts
Lock bolts are used to fit the roof to the body sides
Twist in the car body is checked using a jig and adjustments made prior to tightening the huckbolts
Sealant is applied and lock bolt covers fitted
Finally, the cab and intermediate end modules are moved into position and aligned.
Body shell is now complete and moves to the next stages where bogies attached and interiors fitted out.
The finished article...
Thank you!