Complete Knock Down (CKD) System for Rail Vehicle Construction

NewRail | Newcastle University | UK.

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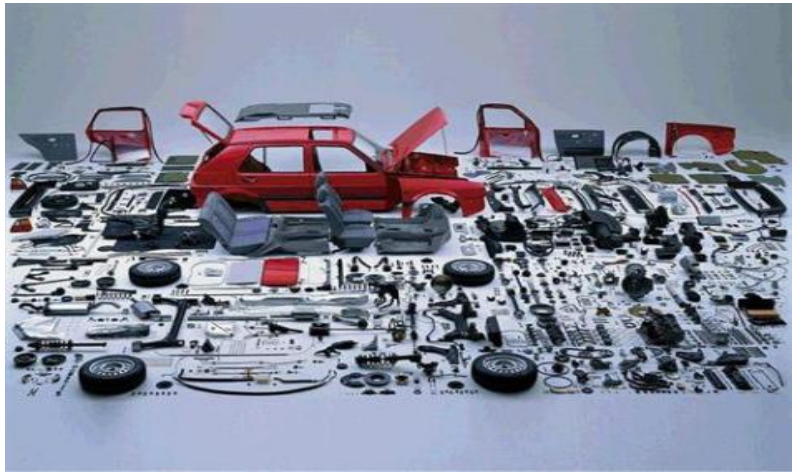
Completely Knocked Down. What does it mean and why is it used?



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

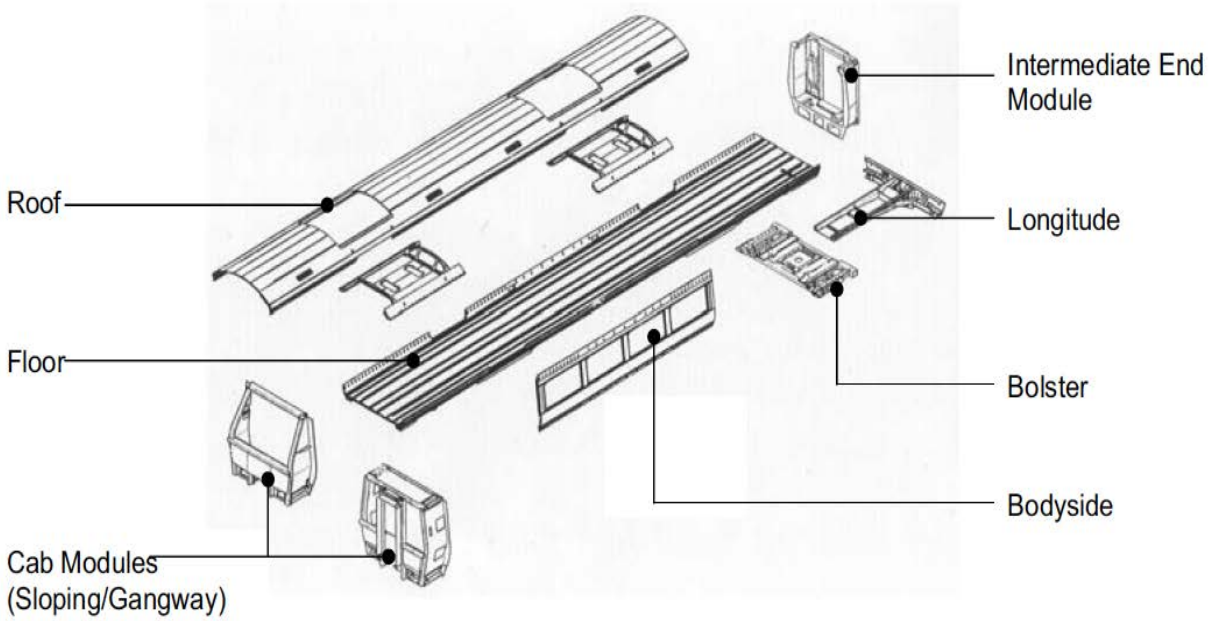


Fig 1 Components of a 'Complete Knock Down' (CKD) vehicle

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.

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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

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Extrusions delivered in fully machined kit form

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First step in the process is to create all the major sub-assemblies such as the floor and underframe structure

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Floor planks and sole bars are set-up in specially designed jigs where they are automatically welded

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Stiffeners are manually welded to the underframe structure

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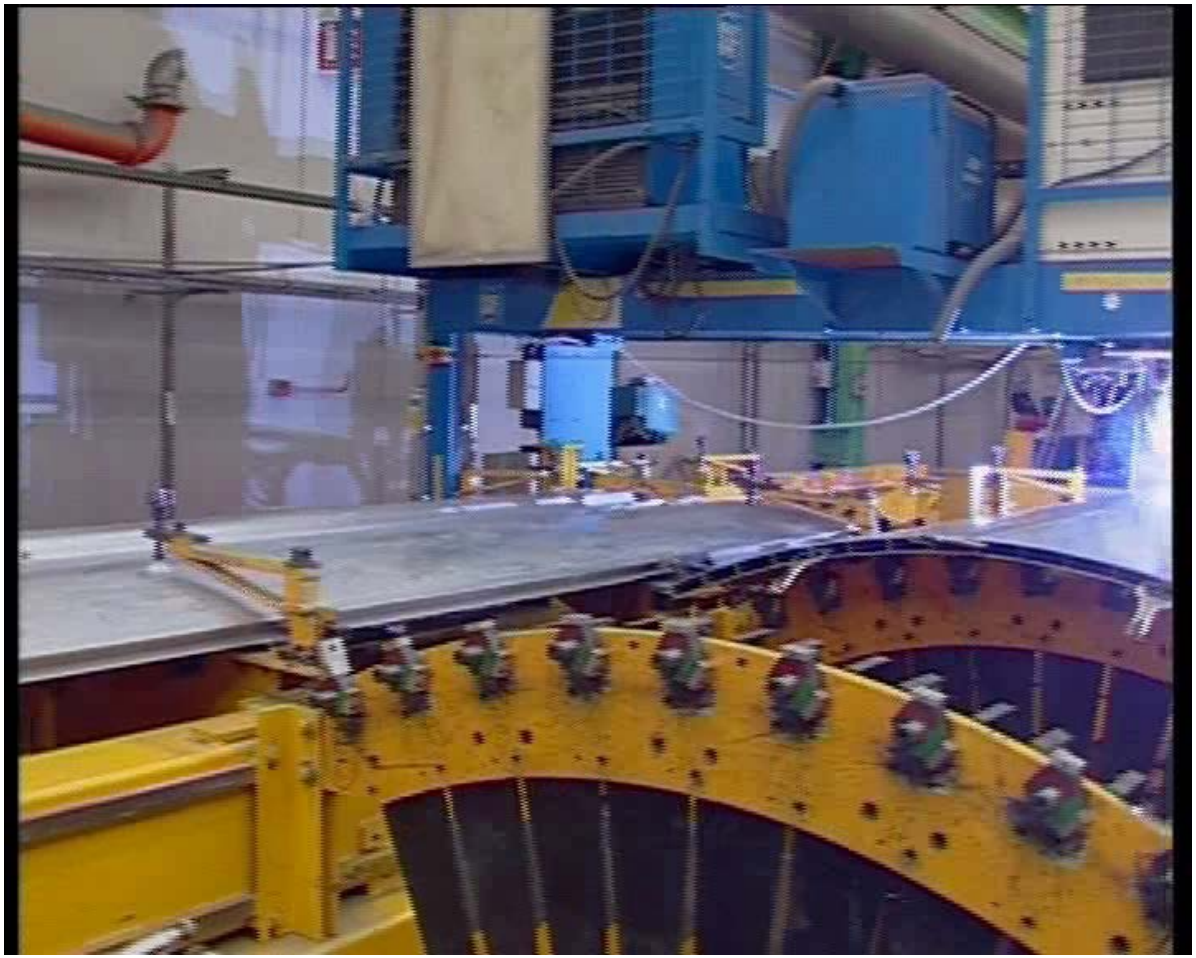
Prefabricated drag box assembly is lifted into place and bolted to the completed structure

The roof planks are set-up in the jig



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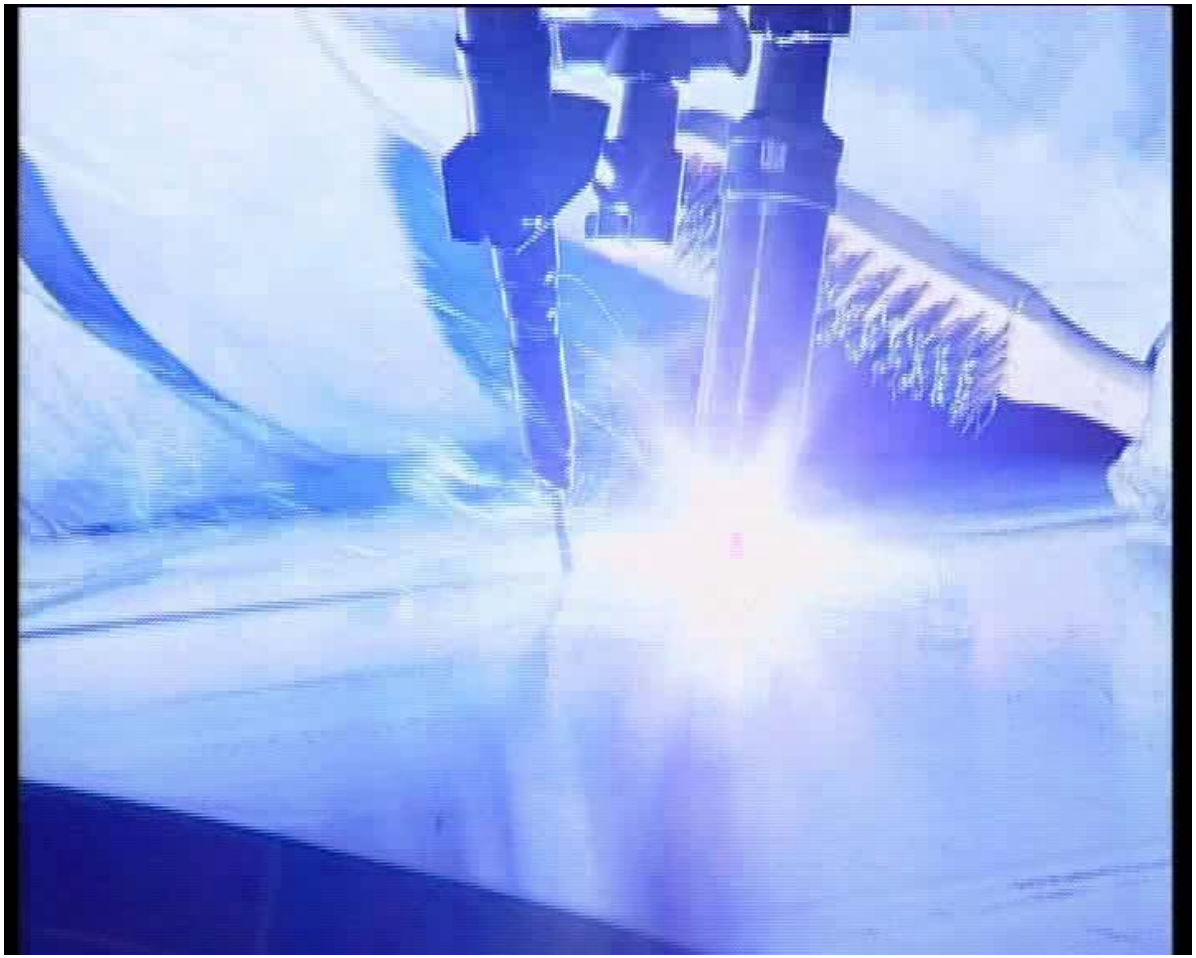
and welded to form the finished structure



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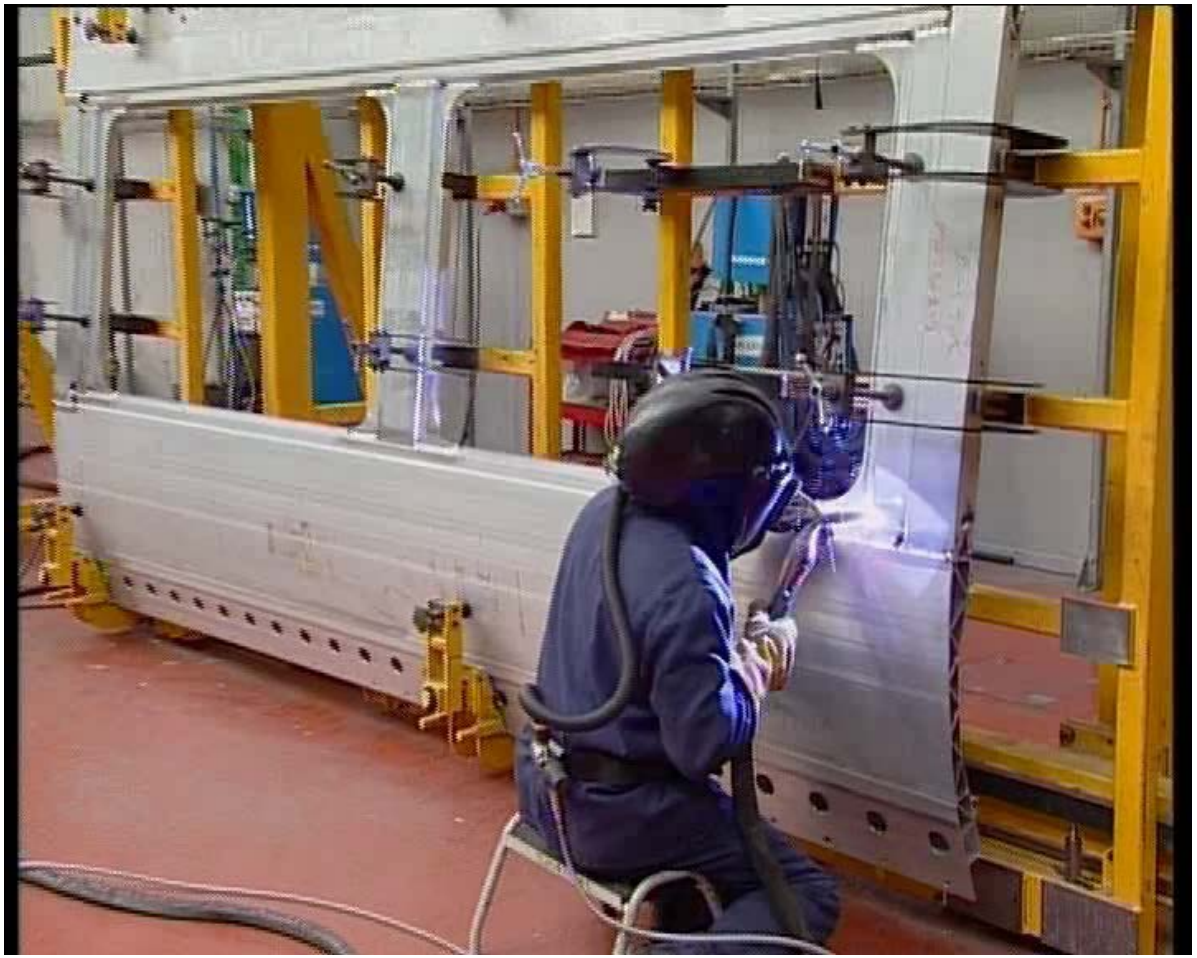
The body side sub-assemblies are fabricated (everything delivered in kit form)



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The completed underframe, roof and body side sections are then transported to the paint shop

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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

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Body sides fitted out and insulation added

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Fitting of interior trim panels

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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

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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

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Sealant is applied and lock bolt covers fitted

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Finally, the cab and intermediate end modules are moved into position and aligned

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Body shell is now complete and moves to the next stages where bogies attached and interiors fitted out

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The finished article…

Thank you!

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