Class 158 Overhaul and Refurbishment Case Study
October 2012

Train Maintenance Delivered

LNWR

Key Project Statistics

Fleet size:	Twenty Four 2 car Diesel Multiple Units
Fleet owners (leasing company):	Angel Trains
Fleet operator:	Arriva Trains Wales (ATW)
Fleet built:	1990/91
Principal routes:	Birmingham to Aberystwyth Birmingham to Holyhead Cardiff to Manchester
Contract commencement:	December 2010
Contract completion:	October 2012
Contract scope:	C6 classified overhaul Interior refurbishment PRM TSI compliance modifications Cab cooling Exterior re-paint Laminated glazing Door system upgrades and replacement door leaves
Location:	LNWR Crewe

The Client's Aspirations

Funded by the Welsh Assembly Government, the interior refurbishment was required to create the impression of a completely new train. This led to the replacement of seating, luggage racks & stacks, carpet, sidewall panels, lighting and interior finishes.

In addition a passenger information system was added.

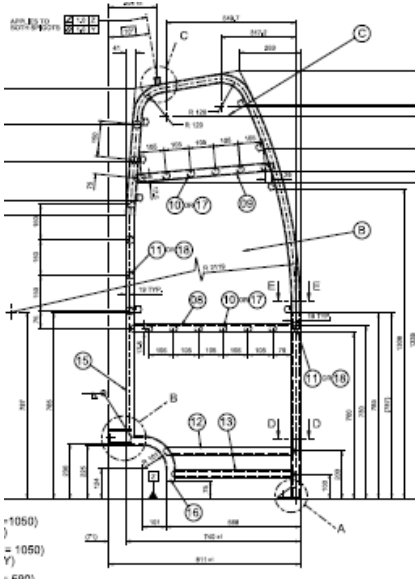
The opportunity was taken to bring the train up to date with provision for disabled passengers and cyclists being part of the specification.

Externally a repaint in the new Arriva Trains Wales livery completes the picture.

The Design and Engineering Process

LNWR adopts an approach to the design and engineering solution tailored to meet the needs of each project according to its individual requirements. This allows the best experience, knowledge and capability relevant to the fleet and scope to be selected. LNWR does not carry its own design department but works with selected specialists for each new project. Supplier selection typically occurs pre-bid in order to maintain a continuity of approach.

For the Class 158 project, LNWR selected Atkins who supported the creation of the bid response. This included potential design and engineering solutions in response to the client specification based on comprehensive fleet knowledge. In some cases a number of options were presented for review before the final specification was agreed.



Atkins supported the post contract award process at every step evolving solutions productionised for ease of assembly and maintenance / repair. First fit was supported through a continuous site presence and effective link with the design team to permit easy and rapid detail amendment.

Design and engineering change packs and engineering compliance sign-off were provided by Atkins as part of the scope

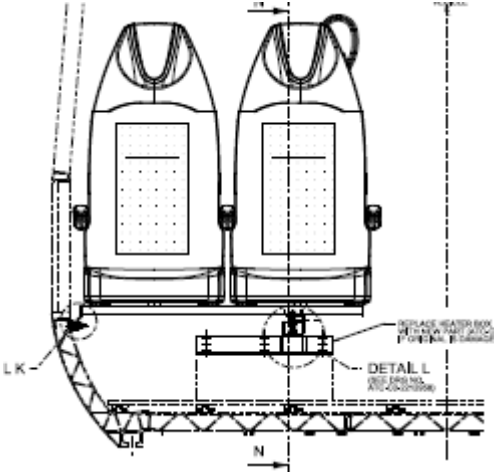
Supplier Selection

LNWR was able to use its extensive network of specialist suppliers to provide a high quality solution delivered reliably on time. The scope was broken down into packages of work and a rigorous selection process used for appointment of key suppliers based on:-

- Experience
- Track record
- Resources
- Management and Quality Plan
- Responsiveness
- Financial Strength
- Cost

Seating

LNWR worked closely with the client to select the Grammer IC3000 seat. Seat data and samples were obtained from a number of potential suppliers and a joint assessment took place to select a comfortable, durable and cost effective solution.



Lighting

A contemporary mix of long life, low energy T5 tubes and LED down lights throughout the whole train delivers an approximate power saving of 500W per vehicle.

T5 have a life of 50,000 hrs easily out-performing conventional fluorescent tube installations and reducing on-going maintenance costs to the operator.

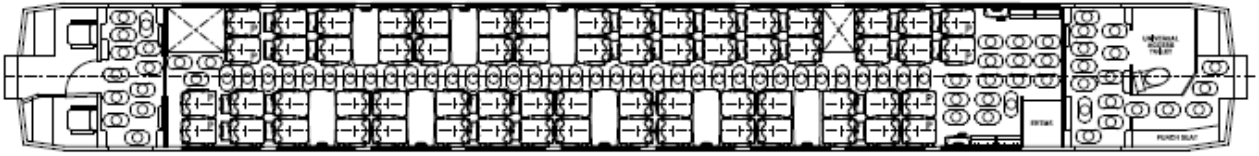
LNWR worked closely selected supplier Teknoware to deliver ATW's design aspiration, contemporary vestibule and toilet lighting whilst reducing energy consumption

Exterior Livery

LNWR worked extensively with paint specialists WG to provide a carefully selected paint system for exterior paint that would not only perform in the harsh in-service environment but be of a quality standard that exceeds expectation. As part of the paint development package LNWR specified, designed and installed a bespoke specialist booth on site at the Crewe facility.

Weight Control

Since manufacture, the Class 158 units have undergone a number of modifications including most recently the fitment of the ERTMS system for operation on the Cambrian Coast line. All of the changes including those proposed as part of this latest refurbishment have increased vehicle weight. LNWR worked with Atkins to accurately assess past weight changes and projected changes for the refurbishment to satisfy the client that safety and kinematic envelope were not adversely affected. The work also included revised assessment of passenger loading required because of the new interior layout and greater standing areas potentially used when crush laden.



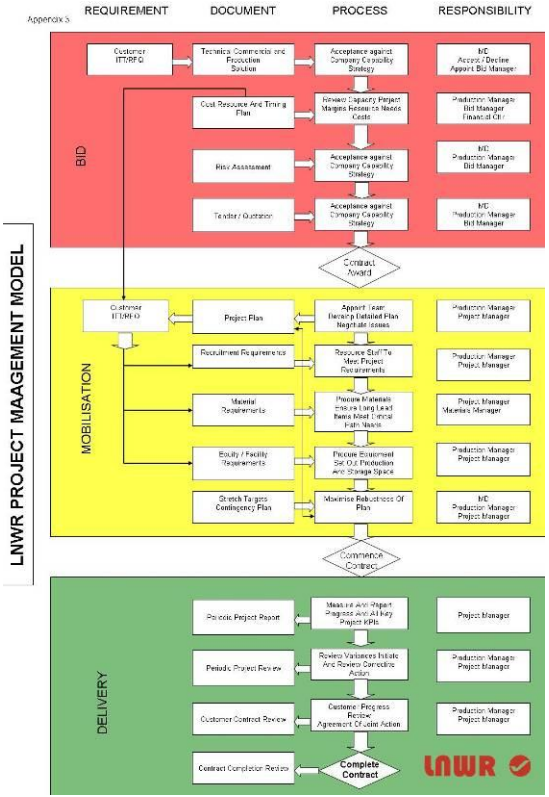
Project Enablement

LNWR converted part of an existing maintenance workshop to provide a dedicated project facility including 2 pack spray paint and line-side materials stores.

A full project team was established on contract award under the management of Simon Taylor, LNWR Heavy Maintenance Manager. This comprised a project engineer, production engineer and a specialist consultant with direct fleet knowledge.

Atkins design work was initiated even pre-contract award. Design completion and sign-off was closely coordinated with component and materials lead times to ensure overall programme milestones were achieved.

LNWR's Project Management Model has proven invaluable in ensuring the management of risks and the effective delivery of resources.



Three Week Beat-Rate

Detailed task sequencing and close coordination of the production teams has allowed the achievement of a 3 week output beat rate for the programme. This has greatly contracted the overall project duration and allowed a single unit to be out of service at any one time.

The period from contract placement to output of the first unit was also remarkably short. Work commenced on the design in September 2010 and the first unit entered service in early April 2011 with all units completed their scheduled work on October 24th 2012.

The success of LNWR in achieving these tight cycle times is rooted in careful planning and a teamwork approach involving designers Atkins, Arriva Trains Wales, Angel Trains and the supply chain to enable effective decision-making and robust lead times.

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