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NETWORK RAIL
LONDON NORTH WESTERN
TERRITORY

Buxton Station Canopies

Design Solution Report

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Introduction

Buxton railway station serves the town of Buxton in Derbyshire England. Buxton Station is a terminus of the Buxton Branch from Stockport. The station is oriented on a north east to south west axis and trains enter the station from the north east. The two platform station is used by Northern Rail for Manchester to Buxton lines.

The main station building dates from 1863, substantial demolition works were undertaken in 1970. The reminder to the 1863 structure and station buildings are Grade II listed.

The current operational station building (ticket office) comprises of a single storey slate pitched roof and flat roof building, with pitched faced stone, including stone window/door surrounds. Windows and doors throughout the building are timber sash all of which are single glazed with the exception of the waiting room entrance door and platform entrance door which have been replaced with aluminium. There is a large cantilevered canopy supported on cast iron columns and timber purlins to part of the front elevation covered with built-up mineral felt.

Platform 2 is adjacent to the main station building and comprises of a large cantilevered canopy (replaced in the last 10 years) attached to the station building and supported on steel columns and steel & timber purlins to the length of the building, the canopy is covered with steel profile sheet cladding. The surface of the platform is tar-macadam to the full length.

Vehicular access to platform 1 & 2 is off Station Road, via an access road and there is a small car park adjacent to the main station building.

The objective of the scheme is to remove the rot affected timbers to the station building and canopy roofs, renewal of roof coverings to main entrance canopy and station building including rebuilding of chimney stacks, install new chemical or similar approved damp proof course to the large areas of the station building including providing new plaster and decorations, replacing the rot affected timber floor to the locker room with a solid floor, replace damaged copers to platform edge, provide new heritage style lighting to the main entrance and platform canopies and finally provide gated barriers at the ends of platforms to prevent unauthorised access on to the running lines.



Pic: Canopy Elevation

Station Building Front Canopy

The front canopy is currently supported with a temporary scaffolding structure due to a large amount damage to the canopies timber structure. The area below the canopy has been closed off to public use and hoarding off for the public's protection.

A detailed structural inspection of the existing canopy's timber structure has been undertaken and defects were noted.

The existing canopy roof is made up of a felt membrane covering over a timber ply / boarding base. This timber boarding base is in turn supported on 3No rows of timber purlin's which are supported by 6No timber beams which are supported by cast iron columns and the building structure. These main beams also cantilever out beyond the cast iron columns.
The canopy roof drains towards the station building where there is a shallow built in timber gutter, this gutter drains into 3No downpipes at the front of the station building.

During the detailed structural inspection the following damage was recorded.

- 3 of the 6 main Timber cantilever beams have extensive wet rot damage adjacent to the internal gutters. The rot damage extends approximately 900mm from the building edge.
- All of the main cantilever beams appear to show excessive deflection at the cantilever tip. The cantilever tip supports the end line of purlin's and the Valance Fascia. The deflection was first notice visually and confirmed by line and level.
- The line of purlin's adjacent the valley gutter also has extensive wet rot damage. This rot damage extends up to 900mm either side of the downpipe / gutter positions and on the centrally spans.
- The central line of purlin's in the canopy width shows signs of excessive creep / deflection. Again this is very obvious visually but was confirmed by line and level.
- The external line of purlins supporting the valance fascia appeared to be in a reasonable condition, some creep deflection of the purlin was evident but this did not appear excessive. From car park level the front valance does appear to be deflecting however this is due to the cantilever beams deflecting rather than the end purlin's and valance Fascia itself.

Due to the level of damage and excessive creep deflection observed a full design check was carried out on the existing timber beams to asses there current capacity.



Pic: Rotted Purlin adjacent to Valley Gutter



Pic: Central Purlin showing excessive Creep deflection

Design Process

This design check found that all the existing members fail in either bending capacity or deflection and in some cases both. With this information, the restrictive details we have to work with and the amount of timber damaged by wet rot observed, repair and strengthening the existing timbers was discounted as an option.

Given the structures Grade II listing our preferred solution is to replace the timber sections with equal sized timber sections made from superior timber. Calculations were produced to prove the new solution.

As part of this design, given the very large spans and relatively high loads for timber we looked at using Glulam Hardwood Structural Grade Timber. The design is restricted by the current timber depth sizes i.e 195mm with Notch's on some. Our new design was carried out to suit design loading from BS6399-2.

Note: Given that the Purlins span 5.8m – 195mm deep timbers are extremely small.

Attached are calculations which give the results of the timber replacement solution.
You can see that the timber replacement option would require us to add a large number of additional timber sections as well as replacing the existing ones.

Again this was seen as excessive and the solution would take from the current appearance of the structure. Also the cantilever sections are supported on cast iron columns this detail could not work if additional timbers were added.

Design Solution

Following this – The preferred solution was to match as close as possible the current appearance of the roof structure.

It was decided for the long span purlins to use standard I sections encased in timber.
For the cantilever sections it was decided to use a RHS section.

Note: The design properties of steel are far superior to that of timber which allows use to use physically smaller sections which meeting design requirements.

It is thought that once the new members have been painted the appearance will be very similar to the existing painted timber elements.