2.0 Site Location and General Description of the Bridge.

Creets Bridge crosses Kex Beck approximately 0.5 km east of Kirkby Malzeard, near Ripon, North Yorkshire. For the purpose of this description, it will be assumed to lie on an east-west alignment.

The bridge is constructed of well dressed sandstone. It has a span of 6.36m, and the load of the bridge is carried by a segmental arch that rises 1.15m above its springing level. The full length of the bridge is approximately 21.8m, and its width 4.90m, (see Plate.1).

The parapet is three courses in height, the topmost course consisting of doubly chamfered coping stones. The distance from road surface to top of coping is c.1m. The copings do not overhang the inner face of the parapet, but do overhang the external one. When this description of the bridge was made (June 2002) only the south parapet was extant.

Immediately beneath the parapet is a string course that is offset from the masonry above and below it. It runs the entire length of the bridge, being interrupted only by the masonry of the abutments. The east and west abutments are c.1.20m wide and are some 0.16m proud of the face of the bridge. The stones of the abutments are in general larger than those found in the parapet or the spandrels, measuring up to 0.63m x 0.40m. In June 2002 the abutments on the north side of the bridge were both extant, although the structural failure at the base of the eastern one was clearly visible. On the south side, the west abutment was extant, but the east one was not.

At the west end of the bridge are two masonry piers or newels. Each pier consists of a plinth (almost entirely obscured) surmounted by four worked stones, each of which is chamfered at its corners and is 0.55m x 0.55m x 0.40m in size. Each pier is topped by a stone carrying a moulding and a concave chamfer, above which in its turn, is a stone with a convex chamfer. This is surmounted by a wooden ball finial, the original stone ones having been taken from both the north and south sides of the bridge. Although the northwest pier appears to be largely original – save for its ball finial – the southwest one is, save for its copings, a later replacement, the masonry having been machine cut. Presumably the pier was struck by a motor vehicle.

3.0 A Brief Survey of the Structural Damage to the Bridge and the Subsequent Engineering Works.

Creets Bridge sustained damage during the severe floods of autumn 2000. The abutments of the bridge were set on quite shallow foundations, leading to the eastern one being seriously undermined by the scouring action of the flooded beck. This lead to the collapse of the facing stone on the north side of the east abutment, and severe damage to the parapet on this side of the bridge, (see Plate.2). The arch had also slumped as a result of the serious undermining of the abutment. On the south side of the bridge, the lower courses of masonry of the east abutment had failed, although the upper masonry remained in place, (see Plate.3).

Prior to stabilising the bridge itself, the engineers laid a gravel bund across the beck, containing pipes allowing it to flow without impediment. The arch was supported by an 'A'-frame steel structure, the corners of which were set in concrete foundations. Timber sleepers were placed on top of the steel work, so that the arch might be supported without damaging the masonry.

On the east side of the bridge, all the abutment foundations together with the springers for the arch, had to be removed. Holes were drilled through all the stones of the lowest remaining course of the arch, and then steel rods were passed through them for attachment to the 'A'-frame, thus ensuring that the remainder of the arch did not fail.

During the course of the watching brief, the parapet above the east abutment on the south side of the bridge was removed, along with the spandrel masonry beneath it and the abutment masonry itself. On the north side of the east abutment, what remained of the spandrel masonry was removed, together with the portion of the arch vaulting that had failed. As has been mentioned above, all the arch springers on the east side of the bridge, together with the abutment foundation stones, were removed. Each stone was individually numbered with spray paint on a non-visible side, and then stored on a pallet.

4.0 Archaeological Background.

Creets Bridge is a grade II listed structure. Since bridges are often replacements for previous structures, it is possible that remnants of such a structure might be detected. Evidence of an earlier ford might also be uncovered.

5.0 Methodology.

As has been detailed, the dismantling of the relevant sections of bridge required the removal of the fill of the bridge, and of the individually numbered stones. The removal of all such stones was monitored at all times, and once an individual stone was removed, it was inspected for features of interest, such as masons marks, or indications of reuse. Various stones in each context were measured to obtain average dimensions. During the dismantling of both the masonry and the removal of the fill, a photographic record was made along with a written one consisting mainly of *pro forma* sheets. Black and white photography was undertaken with a 35mm camera, using archive stable film, and some colour photography was undertaken with a digital camera to produce suitable shots for inclusion in this report.

The fill of the bridge was removed by a 360° back actor, using either a smooth bucket, or a toothed one depending on circumstances. Some fill was also removed by hand. All removal of the fill was monitored, and where appropriate, hand cleaning by trowel was carried out. As with the masonry, *pro forma* context sheets were compiled and photography undertaken.

6.0 Results and Discussion.

During the works undertaken for the installation of the gravel bund, a worked piece of limestone was uncovered from the beck in the vicinity of the bridge. It measured 0.70m x 0.51m (maximum) x 0.20m (maximum). On its single fair face it carried the inscription '*Built by Ias* [James] *Clarkson and Ino* [John] *Gill junr Anno 1749 Musa Mechanica*', (see Plate.4). The term *Musa Mechanica* translates as the 'Goddess of Mechanics', so presumably the builders were quite proud of their work! The stone was found with the inscription face down. The inscription itself is very fresh, having been protected from damage by its position. If it was originally part of the bridge, then it presumably ceased to be so fairly early in its life. Though the stone is of a different material from the rest of the bridge (which is of a quite gritty sandstone) this may only be because limestone could be expected to take lettering better. However, it is difficult to see from the present nature of the bridge, where the stone might have come from. It may well have once been part of the parapet, which does show evidence of repair. In a 250 year period the parapet is likely to have been damaged many times.

6.1 Road Surface and Fill of the Bridge.

The modern road surface (1000) consisted of a 0.12m thick layer of tarmac, upon a 0.20m base of hardcore and pebbles set in a light yellowish brown sandy, silty clay matrix (1001). This layer is quite laminar, and it is possible that in its lower portion, part of the 18th/19th century topping for the road might be preserved. Below (1001) the backfill of the bridge consisted of two contexts - (1002) and (1003). The first context comprised a 0.40m thick layer of dark reddish brown, sandy clayey silt, with frequent inclusions of cobbles of a diameter up to 0.12m. This sub-base appeared to consist of material taken from the beck, and was probably part of the original bridge fill. Below it was a layer (1003) comprising the main fill of the bridge. The layer was greater than 1.50m deep, comprising a dark greyish brown, sandy clayey silt matrix containing frequent large cobbles of average diameter 0.25m, and some up to 0.45m in diameter. Close to the masonry of the arch (1006) the cobbles were set in a loose creamy white mortar matrix that contained many voids. (1003) is, without doubt the original fill of the bridge, and like (1002) appears to be comprised of locally obtained alluvial materials, (All the contexts referred to above may be seen in Plate. 5). The engineers were surprised that the fill was so predominately of 'fines'. Though the cobbles found in (1003) were of quite substantial size, it had been expected that the bridge builders would have used a more

substantial fill containing large pieces of masonry - particularly in the vicinity of the arch. Such a massive fill helps counteract the thrust of the arch.

6.2 The Masonry Structure.

To understand the masonry structure and its relationship to the fills discussed above, it is best to consider the bridge in terms of its construction sequence. The springers for the arch (1006) were carried on a shallow foundation (1007) comprising of two courses of masonry. The lower stones were roughly triangular in shape when viewed from above, being of maximum length 0.60m, maximum depth 0.70m, and some 0.30m thick. The upper stones were very large, and of average size 1.20m x 0.50m x 0.30m.

The stones of the arch (1006) varied a little in size depending on their position within the structure (see Plate.6). In general, the stones lower down the arch were larger, being up to 0.90m x 0.34m x 0.40m thick. On average, those in the upper part were 0.58m x 0.24m x 0.40m thick. All stones were bonded together with lime mortar, and most were only roughly finished on their inner face. The exceptions to this were the twelve reused coping stones (see Plate.7). These varied in length, but each was doubly chamfered and 0.25m in width - somewhat less than those in the present parapet. It is possible that these copings have been reused from an earlier bridge, although they may of course have come from an altogether different structure.

For the sake of simplicity, the masonry of spandrels, abutments, and parapets - in effect, the facing stones of both the north and south sides of the bridge - has been given a single context number (1005). As has already been noted, although the masonry of the spandrels and abutments appears to be wholly original, the south parapet does show signs of having been repaired. After the arch (1006) had been constructed, then the masonry of (1005) would have been raised. The depth of this stonework varies from 0.55m in the abutments, to 0.40m in the spandrels, to 0.33m in the south parapet.

Backing the spandrel and abutment masonry, was a layer of rubble stone and cobbles, some 0.50m wide, and bonded together, like the masonry of (1005) and (1006) with lime mortar. Presumably (1004) was laid down after the raising of the facing stones, to increase the overall width of the wall and resist the outward movement of the very loose fill (1003). (1003) does in part lie over the top of (1004).

6.3 Timberwork.

One timber was noted during the watching brief. Some 10m downstream of the bridge a large timber was observed lying close up to the east bank of the beck (see Plate. 8). At the time it was recorded, one end of it was covered by part of the gravel bund associated with the engineering works. It was at least 4.10m long, of a width between 0.31m and 0.37m, and at least 0.16m thick - though the latter was hard to estimate accurately due to the fact that the timber lay partly buried in silt. It had a pronounced kink or 'elbow' around halfway along its length, and might well have been a cruck timber. Two mortices were observed, one being 0.25m x 0.09m and the other 0.19m x 0.05m. These may well have carried longitudinal rails for the fixing of the stud framing.

If it is a cruck timber, it is unlikely to be later in date than the 17th century, and may have been taken from a demolished dwelling to be reused as part of the formwork for the construction of the bridge arch, or as coffering for the construction of the abutments.

7.0 Conclusions.

The recovery of the date stone from the beck was an exciting find, and the balance of probability points to its having at one time been a part of the bridge structure. The incorporation in the arch of reused coping stones, means that there is a very strong possibility that there was a masonry bridge pre-dating the current one.

8.0 Appendix 1 ~ List of Contexts.

Context	Description	Interpretation	Depth/ Dimensions
unstrat	See opposite	Single piece of worked limestone bearing the date 1749 as part of inscription	0.70m x 0.51m (max) x 0.20m (max)
1000	See opposite	Tarmac surface	0.12m
1001	Weakly cemented and compact light yellowish brown, sandy silty clay containing very frequent inclusions of sub angular and rounded pebbles	Tarmac base/foundation	0.20m
1002	Compact and friable dark reddish brown, sandy clayey silt, containing frequent cobble inclusions. Diameter of cobbles average 0.12m	Probably part of the original bridge fill	0.40m
1003	Compact and firm, dark greyish brown, sandy clayey silt, with frequent inclusions of cobbles of average diameter 0.25m and up to 0.45m	Original bridge fill	> 1.5m
1004	Mixture of rubble stone and cobbles bonded with lime mortar	Rubble core/backing for (1005)	Cobbles no greater than 0.2m diameter. Rubble stone average 0.35m x 0.25m x 0.15m.
1005	Well dressed and ashlared sandstone masonry bonded with lime mortar	Facing stones of abutments, spandrels and parapets	Variable dimensions
1006	Ashlared sandstone masonry bonded with lime mortar	Bridge arch	Average size of stone in upper part of 0.58m x 0.24m x 0.40m. Some stones in lower part, 0.90m x 0.34m x 0.40m
1007	Ashlared sandstone masonry	Foundation of east bridge abutment	Upper course averaging 1.2m x 0.5m x 0.3m. Lower course averaging 0.6m (max) x 0.7m (max) x 0.3m

9.0 Appendix 2 ~ Photographic Register.

Frame	Description	Scale	Date	Initials
Film #1	**Monochrome.**			
1-7	Not used			
8	General view of south side of bridge	1m	5.6.02	DPR
9	General view of south side of bridge	1m	5.6.02	DPR
10	General view of south side of bridge	1m	5.6.02	DPR
11	E bridge abutment on N side of bridge	1m	5.6.02	DPR
12	E bridge abutment on N side of bridge	1m	5.6.02	DPR
13	E bridge abutment on N side of bridge	1m	5.6.02	DPR
14	General view of N side of bridge	1m	5.6.02	DPR
15	General view of N side of bridge	1m	5.6.02	DPR
16	General view of N side of bridge	1m	5.6.02	DPR
17	Dated stone '1749' recovered from Kex Beck	0.5m	5.6.02	DPR
18	Dated stone '1749' recovered from Kex Beck	0.5m	5.6.02	DPR
19	Dated stone '1749' recovered from Kex Beck	0.5m	5.6.02	DPR
20	Contexts (1004) (1005) and (1006)	1m & 0.5m	7.6.02	DPR
21	Contexts (1004) (1005) and (1006)	1m & 0.5m	7.6.02	DPR
22	Contexts (1004) (1005) and (1006)	1m & 0.5m	7.6.02	DPR
23	Contexts (1000) (1001) (1002) & (1003)	1m	7.6.02	DPR
24	Contexts (1000) (1001) (1002) & (1003)	1m	7.6.02	DPR
25	Contexts (1000) (1001) (1002) & (1003)	1m	7.6.02	DPR
26	Exposed upper surface of arch (1006)	1m & 0.5m	10.6.02	DPR
27	Exposed upper surface of arch (1006)	1m & 0.5m	10.6.02	DPR
28	Exposed upper surface of arch (1006)	1m & 0.5m	10.6.02	DPR
29	Reused coping stones in arch (1006)	1m & 0.5m	10.6.02	DPR
30	Reused coping stones in arch (1006)	1m & 0.5m	10.6.02	DPR
31	Reused coping stones in arch (1006)	1m & 0.5m	10.6.02	DPR
32	Large timber approx 10m downstream of bridge	1m	17.6.02	DPR
33	Large timber approx 10m downstream of bridge	1m	17.6.02	DPR
34	Large timber approx 10m downstream of bridge	1m	17.6.02	DPR