



Sapperton Tunnel Report

Informal survey conducted on 30 November 2008

Extract from *The Trow* Number 144, Spring 2009



Cotswold

Canals

Trust

Tunnel Exploration

by Ken Burgin

When I first became involved with the Trust back in the mid-1970s, trips exploring the depths of Sapperton Tunnel were quite common either by boat or on foot. There were no locked gates and there was little awareness of the risks of the build up of carbon dioxide due to the interaction of water with limestone in areas with limited ventilation.

I myself went in on two trips, both using small boats, which went in from the Coates end and managed to get in about two miles until a roof fall was reached which blocked the tunnel completely close to the Daneway end. In order to get this far, it was necessary to climb over several side falls, where the side of the tunnel had collapsed causing material to fall across the tunnel and at least one major roof fall more or less in the middle of the tunnel.

The Trust has always recognised the importance of Sapperton Tunnel, both in its own right as an important part or the nation's industrial heritage and also as a key element in the restoration project to restore navigation from the Thames to the Severn.

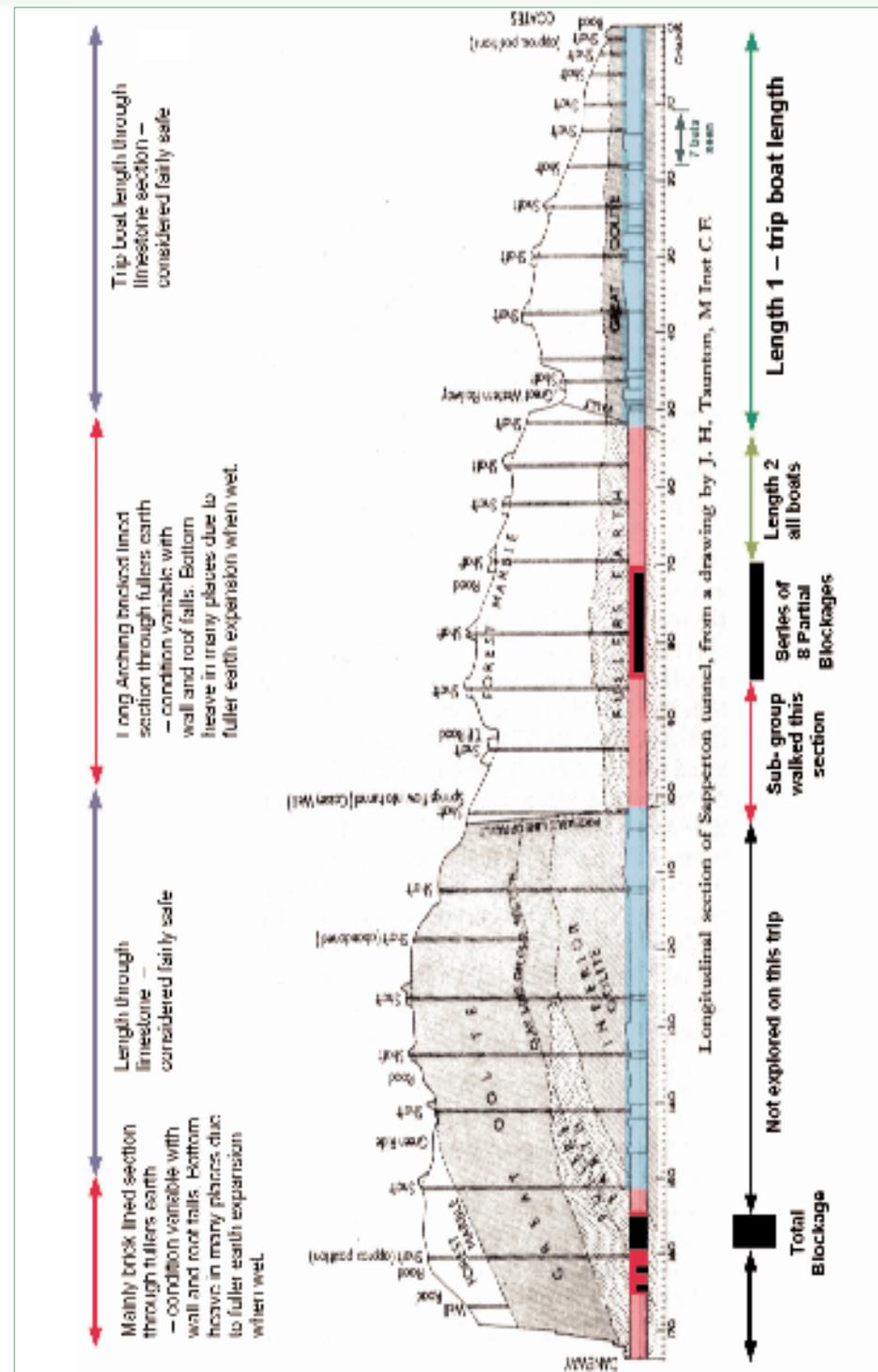
The history of the tunnel is fascinating. At two and a quarter miles long, it was the longest tunnel of its kind in the world when it opened in 1789. Not only was it long, it was of a much larger bore than predecessors like Harecastle Tunnel which is on the narrow Trent & Mersey Canal. When the T&S Canal and this huge tunnel were first proposed there was no shortage of cynics saying that it will never happen (some things don't change much!). Sapperton is longer than Brunel's Box Tunnel (which Brunel rather cheekily claimed was the longest tunnel in the world when it was opened nearly half a century later). It was also straight enough to see right through although there is a slight kink near the middle. The man put in charge of building it turned out to be inept and an alcoholic who spent a significant amount of his time in Gloucester Gaol instead of on site. Only when the canal company dispensed with his services and threw as many work gangs at it as they could find did they recover most of the delays of the early part of the tunnel's

construction. King George III visited the tunnel at the time of its construction and it became a bit of a tourist attraction for the wealthy classes; something doubtless encouraged by the first Earl Bathurst under whose land it was being built and who was a strong supporter of the project.

The tunnel passes through two basic sorts of ground in roughly equal measure. About half of it is through limestone and much of this is through exposed bare rock. The only problem with the limestone is that it can have cracks and mini caves running through it which when the groundwater is high, causes holes to be punched through the clay lining by water pressure thereby causing leaks when the water table falls. The first third of the tunnel from the Coates end is in limestone as is much of the final third. The rest is through a material described as Fuller Earth - the same stuff that cat litter is made of. This has the unfortunate attribute of swelling when it gets wet - OK for absorbing cat wee but not so good in a canal tunnel! There is a substantial length of this ground in the middle of the tunnel and a short section at the Daneway end and it is in parts of these lengths that there have been persistent problems throughout the tunnel's long history.

For many years, the Trust ran an electric public trip boat into the tunnel during those times when there was sufficient water, mainly in the winter. This operated in the first third of the tunnel which runs through the limestone and is considered in a safe condition. This operation was curtailed when BW got involved with the project and found a small number of roosting bats, which are protected species. There were sporadic discussions with English Nature, as it then was, and I understand at one point BW organised a trip for them involving two boats shipped from Leeds especially for the occasion, two sinkings, the use of an air horn in the tunnel, and the sighting of one bat! Not much seems to have happened after that.

With BW off the scene, discussions have restarted with Natural England, as it now is, and a new trip is being planned for them to assess the bat situation. With this in mind, it was decided to organise a dummy run to ensure that whatever kit is used, it will work properly without it turning into a fiasco. It was decided to go in using boats and to use the opportunity to try out some 2.4GHz PMR



radios as a means of communication. The planning of this trip coincided with an enquiry from some geologists about going down the tunnel. One or two others found out about the expedition and the numbers grew as did the number of small boats available which enabled us to consider extending the trip to see what state the tunnel was now in beyond the trip boat section.

Having had to postpone the trip once due to lack of water, we finally assembled on the last day of November to mount the first serious expedition deep into the tunnel in many years. A great deal of planning, risk assessments and method statement work was undertaken to ensure that the trip would be as safe as could reasonably be achieved given that it included climbing over roof falls and passing through sections of quite badly damaged tunnel.

The group included a number of experienced cavers and geologists who had a CO2 detector with them, an experienced bat spotter, and various people from the Trust including Clive Field who was keen to assess the attraction of the potential resumption of public trips. The aim was for all the boats to get to the first of the roof falls near the centre of the tunnel and then to carry some of the smaller ones over the side and roof falls to access the tunnel beyond.

Amongst the craft used was the old trip boat *Gazunder* and because its original electric motor was faulty, this was powered by a smaller electric outboard albeit with some difficulty. I took an electric outboard powered punt and there were a number of canoes. Due to a fairly dry autumn, there was only about 2ft of water indicated outside of the tunnel which is rather less than would have been ideal. For the most part, passage through the initial limestone section was fairly straightforward. It is when the long arching section, through Fullers Earth, commenced that the challenges really started.

The first problem encountered is that the bottom of the canal is not where it should be. The Fullers Earth has swollen under the canal effectively pushing up the bottom. This problem was so severe during the operational life of the canal that long lengths of the brick invert were removed and replaced by timber struts in an attempt to prevent the

walls moving inwards - these subsequently broke under the pressure. One presumes that any further swelling of the underlying Fullers Earth was simply dredged out of the way. The situation today is that there are significant lengths where the canal is a lot shallower than it should be and this caused the boats to ground.

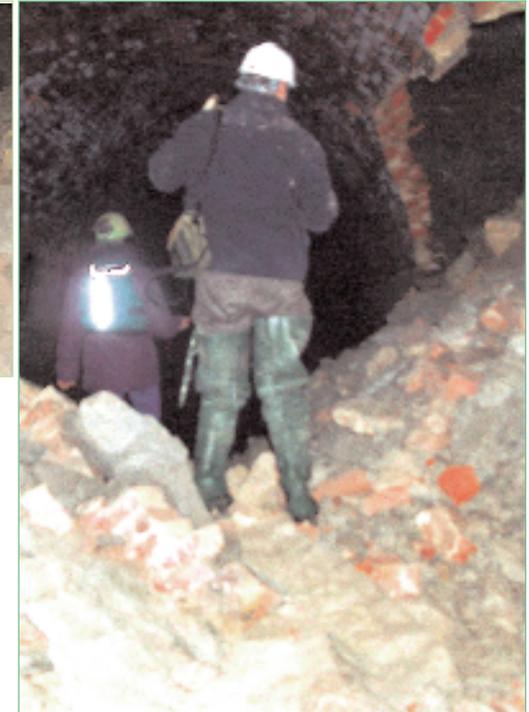
The tunnel is 174 chains long (a chain is 66 feet or approximately 20.3m), a little over 3.5km. It is not until chain 71, some 1.4km into the tunnel that the first significant obstruction is found in the form of a roof fall. Until the mid 1960s, it was possible to get right through Sapperton Tunnel although there were roof falls at the Daneway end and in the middle to climb over with some dating back to the time of the first world war. When I first knew the tunnel in the late 1970s, there were one or two side falls and a larger roof fall in the middle. This middle roof fall could be crossed by climbing over it into the void left by the collapsed material and back down the other side; the top of the fallen material being at roughly at the height of the top of the tunnel arch. Things have got a lot worse since then, we struggled over 5 roof falls and 3 side falls with some of the canoes before emerging on the other side - only to find the tunnel virtually empty of water. We were at about chain 84 and taking the badly distorted walls into account on either side, it would appear that this really bad section is constrained to a roughly 300m length.

Beyond these central falls, the long arching continues for another 370m or so with the walls and roof looking in a quite reasonable condition. In the absence of water, the floor of the tunnel seen from this point is quite startling with broken timber struts rising from the bed of the canal for as far as the torches would illuminate. These are in the form of round tree trunks of perhaps 20-30cm diameter with the location of each indicated high on the tunnel wall above in black paint. In between, the Fullers Earth has raised the bottom up and it is probably this now which prevents the walls moving inwards.

We walked along the tunnel to the point where it enters the second limestone section at about chain 102. At this point, the bottom becomes lower and is covered by a very thick and sticky layer of puddle clay making further progress extremely difficult. The decision was made to turn back,



Above: Breach of both walls looking north



Right: Ken Burgin at the first fall

Below: Leading canoe with plenty of water in the first "trip boat length"

(All photos by Mark Welton)



not least because the method statement instructed those waiting for us to call the emergency services if we failed to return before a given deadline. The PMR radios were found to work well in open tunnel but, as was anticipated, the signals struggled to get over the falls because the radios were no longer operating line of sight.

The trip back was uneventful except for one incident. Since my first involvement with canals, I have never fallen in. As we approached one of the last falls on the way back, the canoe I was in decided it would capsize just as I was climbing out over the bow and in I went. It wasn't that deep but I did go right in. It didn't even feel particularly cold and the only thing that really mattered was getting the battery out of my mobile phone quickly to prevent potential damage.

So what did we find?

Seven bats were spotted on this particular trip, all as individuals within the first 18 chains from the Coates end and they remained motionless as we quietly passed by.

The central section is deteriorating and this could well be exacerbated by the actions of a local farmer who has dumped many tonnes of material into the canal about a mile east of the tunnel thus effectively damming the cutting leading away from it. This causes the water levels in the tunnel to rise way above normal operating levels after really wet periods thus exposing previously dry beds of Fullers Earth to water.

We proved that access to the far limestone section is still possible and that, on this occasion at least, the CO2 levels were still within safe limits.

What of the future?

We need to take Natural England in to survey the bats and agree on how trip boating can be resumed.

We will need a new trip boat, possibly one that can be used elsewhere at times and particularly over the summer when there is not enough water in the tunnel. To be able to launch

and retrieve it, improvements will be needed to the ramp at Coates.

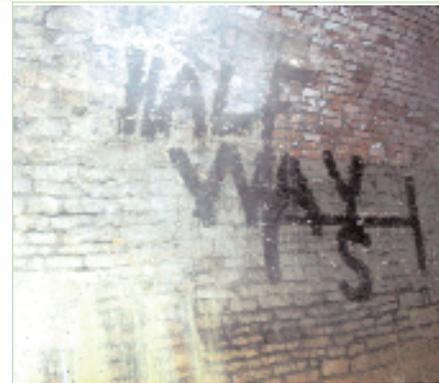
The Coates Portal was rescued from collapse and restored by the Trust in the late 1970s being one of its first big projects. Thirty years of frosts have taken their toll on the delicate stonework and it is in need of some tender loving care.

Something needs to be done about the dumped material in the canal east of the tunnel. Not only is this putting a national heritage treasure at risk but the 8ft swings in water level it causes have already damaged the existing trip boat installation in the tunnel and would a future one.

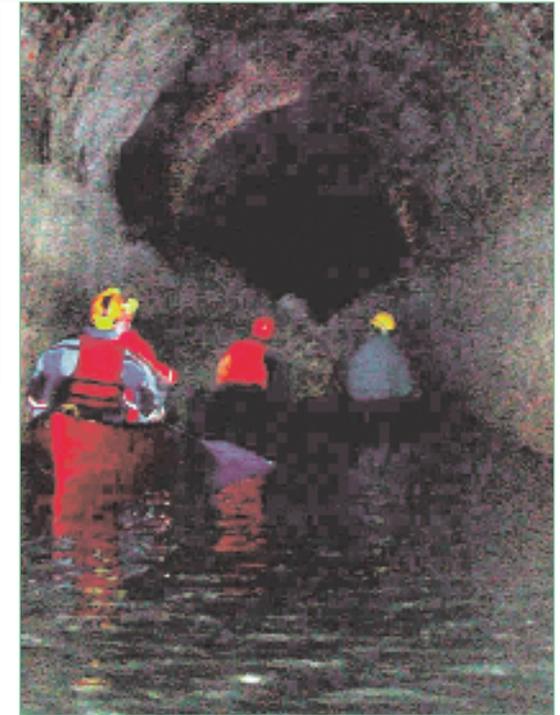
Eventually we want to see the tunnel restored. Of the 3523m of tunnel, about 1600m is through fairly solid limestone and only about 500m of the rest is badly affected by side and roof falls.

Most of the previous engineering reports and studies suggest ripping out the old lining in the Fullers Earth sections and replacing it with modern concrete rings. My hope is that the original 230 year old Georgian brick and stonework throughout much of the tunnel can be stabilised and retained but with a new concrete base installed to provide access for the repair work and to eliminate leakage both into voids in the limestone and into the Fuller Earth. This may not be the cheapest option nor the one which would provide the lowest ongoing maintenance liability. However, it would honour those who had the vision to build the tunnel in the first place and provide the greatest interest for those passing through the tunnel either on their own boat or in a trip boat.

The timing of the full restoration will depend on many factors, not least the availability of a substantial amount of money. The tunnel forms part of what we tend to call Phase 3 and there is still plenty to do to get phases 1 & 2 under way fully - however, if someone would like to give us the money.....



Above: A clue to the location can be found painted on the wall (Photo: Mark Welton)



Right: The first fall around Chain 71 (Photo: Ken Burgin)

Below: Wood beams to the west of the central fall area (Photo: Ken Burgin)

