HEAGE WINDMILL PROCEDURE

Ref HWP 006 Rev 7 Mar 2018

BASIC INFORMATION FOR USE ONLY BY GUIDES TO HEAGE WINDMILL !

GENERAL

Guiding round the mill can be a great pleasure, you meet many people who share an interest with you in things old, including windmills. It's sometimes difficult to get started as a guide, but remember that, with the aid of these notes **YOU will** know more about Heage windmill than most visitors. Read the notes carefully and try and use the key data when you are speaking - the remainder grows on you after a time.
KEEP THESE NOTES FOR FUTURE REFERENCE.

Always speak slowly and clearly and try to involve the group you are speaking to; do you live near a mill? Have you been in a windmill before? Do you know how she (windmills are always ''she'') works? Why do we need to grind wheat *etc*?
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Always carry a 'Name Badge', wear your costume, overalls, a smock coat or your Heage Windmill logo sweatshirt, to denote that 'you are in charge'.
Always advise the visitors of the safety precautions to be followed (See Appendix A).
Do not allow anyone to fool around inside or outside the mill. It could be dangerous to them or to others.

Study the diagram of the mill om Page 9. Ask the miller for advice if you need it!
See Page 8 for further data taken from "Heage Windmill Revealed"

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BRIEF HISTORY OF HEAGE WIND MILL - LISTED AS GRADE 2*

The squat, coal measures sandstone, tower is 26Ft 3in high and total windmill height is 39ft 5in. She has a stone door post to the north entrance door marked 'WSM 1850', the significance of which has never really been established. There are in fact two doors into the mill so that the miller can always safely enter and leave the mill, regardless of which direction the wind is blowing from, since the sails can move round at any time. The mill is built on a small mound and an entrance below could have enabled carts to back right up to the building for loading and unloading. The first indication of the mill is in an advertisement for a tradesman in The Derby Mercury of 16th June 1791,

> 'Heage windmill to be erected, any mason inclined to undertake the stone building to attend at the mill, all materials laid down in place.'

We do not know however if the mill was ACTUALLY built following this notice.
Then soon after an advertisement *appeared* reading, (Derby Mercury 20th September 1798)

> 'To be let - complete smock mill with fantail, two pairs of stones, good dressing machine - made to plans approved by Mr Wass - standing in good situation at Heage'

(Note: We have subsequently learnt that the actual stone for the mill was quarried on the site – we found large quantities during the restoration *work in 2001!)*

From these we have concluded that although we do not know the actual date the mill was built it must have been operational in 1797 so that is the date we normally use when discussing the age of the mill.

The mill was advertised in the Derby Mercury, 1816, offering for lease in Nether Heage “a dwelling house, a smock mill and four acres of land”. However, tower mills were commonly called smock mills in Derbyshire and note should be taken of the above request in 1791 for a mason to build the mill!

There was a small stone building alongside the mill which was used for the kiln (Now Converted to the Visitor Centre). Before restoration the roof had fallen in and only the shell remained. One report suggests that a woman who entered the kiln to turn the grain was burnt to death when her clothes caught fire!

We now know from an old painting that, as built, the mill had a boat shaped cap and was fitted with four common sails, onto which canvas would have been spread. We suspect that the Shore brothers (see below) probably changed the common sails to patents when they bought it.

In 1850 the two brothers Isaac and Joseph Shore purchased the mill, trading as millers and grocers. Some time after this they fitted four patent sails, with shutters rather like venetian blinds, worked by the striking rod which went *right* through the windshaft, *from front to back*. The Mill operated in this form until February 1894 when the cap and four sails were blown from the mill in a violent storm. A contemporary photograph shows a man, presumably the miller, standing on the wreckage of the sails in front of the mill and the brake wheel protrudes from the top of the *cap less* tower.

When the re-build was commenced, it was decided to replace the four sails with six patent sails, presumably to obtain more power, although in other respects the mill was externally similar. The work was carried out by George Chell, a millwright from nearby Fritchley, where a house in the village carries a stone plaque bearing his name and Trade.

The mill continued to be in regular use until 1919, operated by Joseph and Enoch Shore, the sons of Thomas and later by T.J (Tom) Shore. It in fact worked in conjunction with the nearby water and steam mills in the valley to the *south* of the windmill which were under the same ownership, *the only mill complex we know of which had wind, water and steam powered mills.* However, in 1919 the fantail was severely damaged in a gale, most of the blades being lost. The damage was serious and presumably in line with the economic situation of mills at that time, the mill closed down.

It became almost derelict, drawings and photographs in the 1930's showing it with the sail bars hanging down in a totally neglected manner. A report in the Derby Evening Telegraph in 1934 reports that the mill was up for sale by auction and includes a contemporary photograph showing that the fantail was missing and that the sails were not complete. Care was needed it was said when entering the mill because some of the floors were rotten. The view, taken from the nearby road, shows the adjacent Windmill Cottage and mill standing in an area completely devoid of the trees and vegetation which presently surround the site. Karl Wood painted the mill in 1932, standing without the fantail and with the derelict kiln alongside.

It was struck by lightning in 1961 and a photograph in 1967 shows only the remnants of the sails and a stub where the fantail and its staging had been. A preservation order was placed upon the mill by Derbyshire County Council (DCC) in 1966, after *an application to convert the mill into a house was rejected by the planners who then described it as 'the the most complete surviving tower in the county'. DCC, soon after this* became the owners of *the mill and the adjacent land.*

Over the next few years restoration work was carried out by the millwrights Thompson's of Alford in Lincolnshire and new floors, sails, cap and fantail were made. The new sails were hoisted on the 15th March 1972 and the fantail was lifted into place three days later. The mill remains in the ownership of Derbyshire County Council and she was again struck by lightning in 1995 when a sail and internal machinery was damaged, fortunately without causing a fire. Essential repairs were carried out but this event led to the formation soon after, of the Heage Windmill Society, closely followed by the formation of the *Friends* of Heage Windmill.

In conjunction with the owners, DCC, a plan for the complete restoration of the windmill, back to working order was developed, the total cost of which was in excess of £400K. Applications were made for grants to various bodies, including The Heritage Lottery Fund, WREN and English Heritage, now called Historic England, coupled with contributions from local councils, fund raising and sponsorship, all leading to the work commencing in July 2001. Sufficient work was completed for the mill to be formally opened to the public on 1st June 2002. The new access road from Chesterfield Road was constructed and the old access, from Dungeley Hill, was extinguished. The work on the mill was extensive and was such that the mill was brought back to full working order *and flour was produced again on 4th July 2003*, after more than 80 years!
With this background knowledge, you are now ready to start taking your party round the mill

START IN THE UNDERCROFT

The Visitor Centre was originally the kiln, where the grain was dried down to about 12 - 18% moisture before it was taken inside to be ground. If it is wetter it grinds like porridge and clogs up the machinery but *if* much drier it shatters. A fire heated the cereals which were spread out on ceramic or thin cast iron tiles, with numerous small holes in them to allow the heat to pass through. Some fragments of the tiles have been found and are displayed in the Interpretation Centre in the mill basement *along with a model of what the kiln probably looked like*. The weather vane *on the visitor centre* tells the story of the kindly miller who did not want to strain his horse - so carried the sack on his back but *then* sat on the horse!!

The under croft was reputed to have been a stable at some time but was more probably a storage area. Here we have display panels telling the story of the mill, a model of the kiln which was used to dry cereals and a Virtual Reality computer display which enables those who cannot climb up the ladders in the mill to see the mechanisms on all floors.
A model windmill has been added to the undercroft.

The stone flag stones in the entrance were found buried under 3 feet of debris when the initial restoration work commenced in the early 1990's.

Move round the mill a clockwise direction from the Visitor Centre (keeping clear of the sails if they are turning)

On the left, set up as a seat, is a millstone made from Derbyshire Mill Stone grit. It is a bed stone. i.e., this was the fixed stone, and is domed on the reverse side, perhaps suggesting it could be old. A similar stone leans against the wall by the north door into the mill. They each weigh around 1500/2000lbs (700/900kg). On the left set up as a seat is a millstone

Against the large gate/wall there is a new 2017 timeline board.

LOOK UP - The six sail backs, or *whips*, are mounted on a 'cast iron cross', bound with clamps and wedges, and each sail has 21 shutters, a total of 126 in all. They are rather like large venetian blinds, controlled by working the lever mechanisms in front of the cross (known as the spider), by moving a rod which passes right through the windshaft and operated by a chain at the rear of the mill. This device, invented in 1807 by William Cubitt, later Sir William, enables the miller to regulate the amount of sail collecting the wind **without stopping** the sails turning - a very significant time saving device. In the restoration work the 126 shutters were all sponsored for a minimum of £50 and are all numbered. (See sponsors panel on ground floor inside mill which lists who sponsored which shutter'). Note also the twist, or 'weather' in sails - this helps them to gather the wind more effectively. And the lightning conductor wire on the end of each sail. This is connected to earth points round the mill.
When we had to replace two sails in 2005/6 which had been found to be rotten (not part of the 2002 restoration programme) we used laminated Siberian Larch, specially treated in a pressurised preservative tank to ensure maximum life,

You will note the wooden bridge above the entrance to the mill basement. This was originally a storage space when the mill was working and carts *may have been* unloaded into this area to feed the mill with cereals. We have converted it into the Interpretation Centre for the mill and the panels tell the story of the mill whilst a video shows how windmills in general work.
Moving round *the mill*, adjacent to the car park, about 15 feet above your head is the outlet from the fireplace - Heage is one of the few mills with any form of heating - but fire was always of concern in mills.

LOOK UP AGAIN
Above the east door very often is the fantail staging (which was replaced 2017) – this carries the fantail, dependent of course on the direction of the wind. The fantail is a propeller like device (invented by Edmund Lee in 1744/5) which, via gearing attached to the internal curb rack, **slowly turns the complete cap and the sails to face into the eye of the wind.** (*Estimated that the fan turns about 3000 times for one complete turn of the cap!).* You can see the two large timbers on either side of the stage; they are called the 'sheers'. They form part of the huge structure, or framing, which support the cap and the windshaft. The sheers were replaced (1997) due to rot in the exposed front end and the new ones should last 25 or more years. It has now all been replaced in 2016/17. Hanging down is the brake rope, used to operate the brake to stop the sails, which is located round the brake wheel, inside the cap, and also the striker chain, used to remotely adjust how much the shutters are opened and to close them. A model on the bin floor shows more clearly how the shutters work and also on the bin floor there is a diagram showing the operation of the fantail.

Climb now to the BIN Floor.

IMPORTANT – NO VISITORS ARE ALLOWED IN THE CAP.

Look up through the grills into the 20' 2" diameter cap. This is the power house of the mill. The cap is supported on 24 cast iron rollers and maintained centrally by six 'truck' wheels. The cap is held onto the mill essentially by its own weight, although the 'truck wheels' run under a lip on the flanged track of the curb, to limit uplift, if this is ever required! The sails are at the front end and are visible when the hatch is opened.

The iron windshaft was made by the Butterley Company in Ripley, after the mill was badly damaged in the gale in 1894 when it was tail winded - that is the wind blew onto the back of the sails and the cap and brake wheel were blown off (photo in Interpretation Centre). Windmills must always face into the wind so the cap is rotated by the fantail or can be wound manually – quite hard work!! A new Ogee shaped cap was made at that time by George Spendlove, of Heage. The cap has been rebuilt and a section showing the method of construction, from seasoned larch timbers, is displayed on this floor.

The wooden brake wheel is of clasp arm construction and an iron band runs round its circumference to form the brake, normally used for parking, rather than stopping purposes. This is operated from outside the mill by the rope you saw below. Originally it was fitted with wooden cogs but these have now been replaced with cast iron teeth which mesh with the main transmission gear - the Wallower. This is mounted on the top of the upright shaft, a large round, vertical wooden post, believed to be made from oak, which transmits the power to the floors below.

Through the rear hatch you may see the fantail and be able to follow the gear train down to the drive pinions on the rack that turn the cap round. At the rear end of the windshaft are the levers associated with the shutter adjustment we saw outside.

There is a sack hoist powered by friction off the underside of the wallower, by the stairs. It is controlled by pulling a rope which engages the drive. This is used to lift sacks of corn up to the bin floor on which we are standing.

Adjacent to the upright shaft we have built a wooden grain storage bin and built in the flap hatch of the sack hoist, such that grain can be loaded in directly. Note the traditional use of leather straps as hinges.

The grain feeder is made from the nose cone from a Rolls Royce jet engine.

Here we also display a genuine Indian hand quern, which demonstrates how grain in converted into flour and a model dresser, which replicates the action of the full sized machine on the ground floor, in the grading of the meal and producing white flour. There is also a model to demonstrate how the shutters work on the sails. The side towards you represents the face side of the sails.

There is also a board displaying various old tools on this floor along with a chest drill which children can turn and it illustrates to them how smaller cogs work.

Now move down to the STONE FLOOR.

This is where the actual milling process takes place. Grain is fed down the chute from the floor above. There are two pairs of stones; one pair is French Burr stones which is set up and used for milling use. The second pair is made of Derbyshire Millstone grit, their runner stone is raised and is resting against the wall to expose the dressed face of the bed stone and the iron mace on which the runner stone turns. It is supported on its rhynnd; the iron bearing which fits across the eye of the stone. The working stones are now protected with stainless steel to comply with today's Health and Hygiene regulations. The centre plates are removed when milling.

On the upright shaft is mounted the wooden 'Great Spur Wheel (GSW), which drives the 'stone nuts' which in turn drive the stones. The 'GSW' is most unusual in that it had a double row of cogs mortised into the outer rim. These had been removed at some time and they had been replaced by bolt on cast iron gear teeth sections. (See photo of similar double cogged GSW on wall). We have replaced the iron cogs in the way the mill was equipped when it last worked in 1919.

The 'working' pair of stones is enclosed in the wooden Vat, above which is the 'stone furniture', i.e. the horse, the hopper and the chute. The chute is vibrated by contact with the square iron stone spindle and shakes the grain into the eye, or centre of the runner stone. As previously noted, only the top (or runner stone) is turned by the 'quant', or stone spindle. The runner stone is supported on the rhynnd and sits in the mace. Both these features can be seen on the exposed pair of stones. The stones turn at about 120 to 150 rpm. The meal emerges at the outer edge of the stones and is collected in the Vat until it is brushed down chutes or ducts to the floor below to be cleaned and separated into flour or bagged.
Note Flour requires a separate sieving operation to separate it from the bran etc., but it can be used directly as 'wholemeal'.
Note also the bell alarm which is used to alert the miller when the grain in the hopper is getting low. A leather strap attached to the bell lever is buried in the grain but once exposed *when the level falls,* allows the bell to fall forward and start to ring, operated by the *bell frame knocking onto* the stone spindle.
We have to lift the stones about once every year to dress, or sharpen them, but if the mill was working full time this could be a monthly task. *We use a small 'stone crane' to lift the stones, which is assembled in situ when we need it, but the old miller often used ropes and pulleys!*

Return to the Ground, or MEAL Floor.

On the ground floor note the two sets of iron tentering gear and the meal spout from the vat above is visible. The tentering gear involves a system of levers through which the separation of the stones above can be adjusted to very fine limits. This is necessary so the miller can modify the fineness of the meal he is producing. One pair of stones has been fitted with a governor, which automatically adjusts the separation of the mill stones, depending on the power of the wind.
In the centre of the room we have fitted a wire dresser. We can either collect the wholemeal flour directly or can divert it into the rotary wire dresser to grade the meal into various fine and coarser grades *of flour* and to reject any large pieces which may have come through.

Point out the flour scales used for bagging and the specially lined flour cupboards.

Note also the fire place and the two large swing back doors (ensures access at all times, even when the sails are obstructing one set of doors).
Note also the display panels giving the names of the main sponsors and those who sponsored parts of the mill during the restoration work

CLOSURE OF TOUR

Thank the visitors for coming, hope they have enjoyed it, any questions? Please ask them to sign the visitor book.

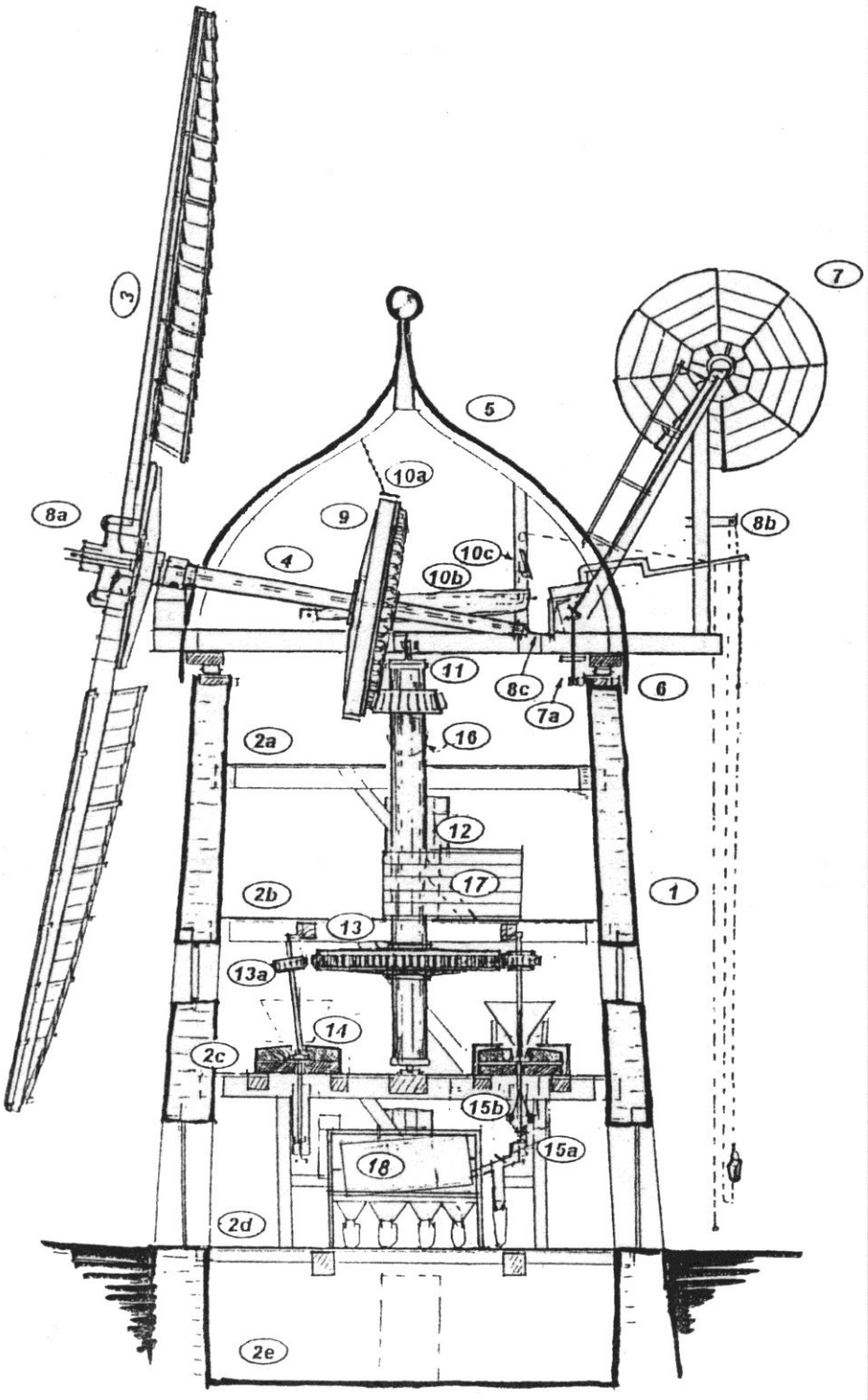
Also, mention Facebook the Mill website and trip advisor as well as leaflets for information on volunteering.

Al*ways ask them to t*ell their Friends about the mill, ask them to return to the Visitor Centre again to see the various memorabilia, *books etc* we have on sale – and to get a cup of tea or something to eat! *Or they may wish to revisit the basement displays.*

AFG. APRIL 1998 (edited October 98). (Major editing Rev 1 23 March 03) (Rev 2, further edited August 2005 Rev 3, edited again Feb 2006 (Rev 4), edited May 2011, edited Mar 2014, edited Mar 2018

Selected Data On Heage Windmill			
Building	**Ft/ins**	**Metres**	**Other Information**
Tower height to curb (415' 8" – 126.69m above sea level)	26' 3"	8.0	Stone
Cap interior height	13' 2"	3.0	Wooden
Total mill height	39' 5"	11.0	
Tower dia. (exterior)	22' 11"	7.0	
Curb dia. (exterior)	19' 4"	5.9	
Number of doors			2 (plus 1 to undercroft)
Number of windows			7
Cap and Sails			
Total weight with fittings			13.5 tonnes
Windshaft weight			1.5 tonnes approx.
Windshaft length	16' 11"	5.1	Cast iron
Windshaft max. dia.	9¾"	0.25	Angle 9 degrees
Length of whips (sails)	30' 0"	9.0	
Width of sail bay	6' 0"	1.83	
Width of leading boards	9"	0.225	
Total area of sails	900 sq.ft.	90 sq.m.	
Fan tail dia.	11' 4"	3.45	
Machinery			
Brake Wheel dia.	8' 0"	2.44	Wooden
Brake Wheel width	11"	0.28	
Brake Wheel No. of teeth			100 cast iron
Wallower dia.	3' 4"	1.02	Cast iron
Wallower No. of teeth			45
Great Spur Wheel dia.	6' 0"	1.83	Wooden
Great Spur Wheel No. of teeth			84 cast iron
Upright Shaft length	17' 9"	5.41	Wooden
Upright Shaft dia.	18" av.	0.46	
Overall gear ratio (stones:sails)			Approx. 10:1
Stones			
Stone Nut overall dia.	18"	0.46	Cast iron core
Stone Nut No. of cogs			20 apple wood
Millstones dia.	4' 6"	1.37	French & Derbyshire
Millstones weight			1 tonne approx.
Operational Data			
Sail r.p.m.			8 - 10 (best operation)
Stone speed r.p.m.			Up to 120 approx.
Flour milled per hour			100kg max.

KEY TO HEAGE WINDMILL AND ITS MACHINERY



Section through Heage Windmill

Drawing Courtesy of Boucher & Sons.

1 Tower

2 Floors
- a) Dust Floor
- b) Bin Floor
- c) Stone Floor
- d) Ground Floor
- e) Basement

3 Sails

4 Windshaft

5 Cap

6 Curb

7 Fantail

8 Striking Gear
- a) Spider
- b) Striking Lever
- c) Striking Rod

9 Brakewheel

10 Brake
- a) Brake Band
- b) Brake Beam
- c) Striking Arm

11 Wallower

12 Upright Shaft

13 Great Spur Wheel
- a) Stone Nuts

14 Millstones

15 Tentering Gear
- a) Bridge Trees
- b) Governor

16 Sack Hoist

17 Grain Bin

18 Flour Sifting M/c

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