ALAN B. PARTNERSHIP LTD.

Health & Safety Advisers

Property	Clitheroe Golf Club
Risk Assessment	New housing development – 1st hole
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Introduction

Alan B Partnership have produced this document, at the request of Clitheroe Golf Club, to assess the issues of golf balls being struck form the 1st tee or fairway into the new Morris Homes housing estate, situated alongside the course.

This document has been produced to objectively assess the risk of wayward or erratic golf shots being played from the 1st tee or fairway and to identify any suggest control measures, to mitigate against the risk.

Summary

- Based on a conservative estimate that an average of 150 rounds of golf are played per week, or 7500 rounds per annum, it is reasonable to expect that a minimum of approximately 150 balls per annum being played towards the housing estate, representing 2% of tee shots from the 1st tee.
- Given the velocities of typical golf balls, a direct strike will cause significant property damage or injury to persons.
- Homeowner actions, since taking residence, have significantly reduced the effectiveness of existing safety measures.
- The golf club has taken steps to encourage golfers to play more conservatively from the 1st tee, with limited impact.
- The club remains concerned about the risk of significant damage or injury being sustained.

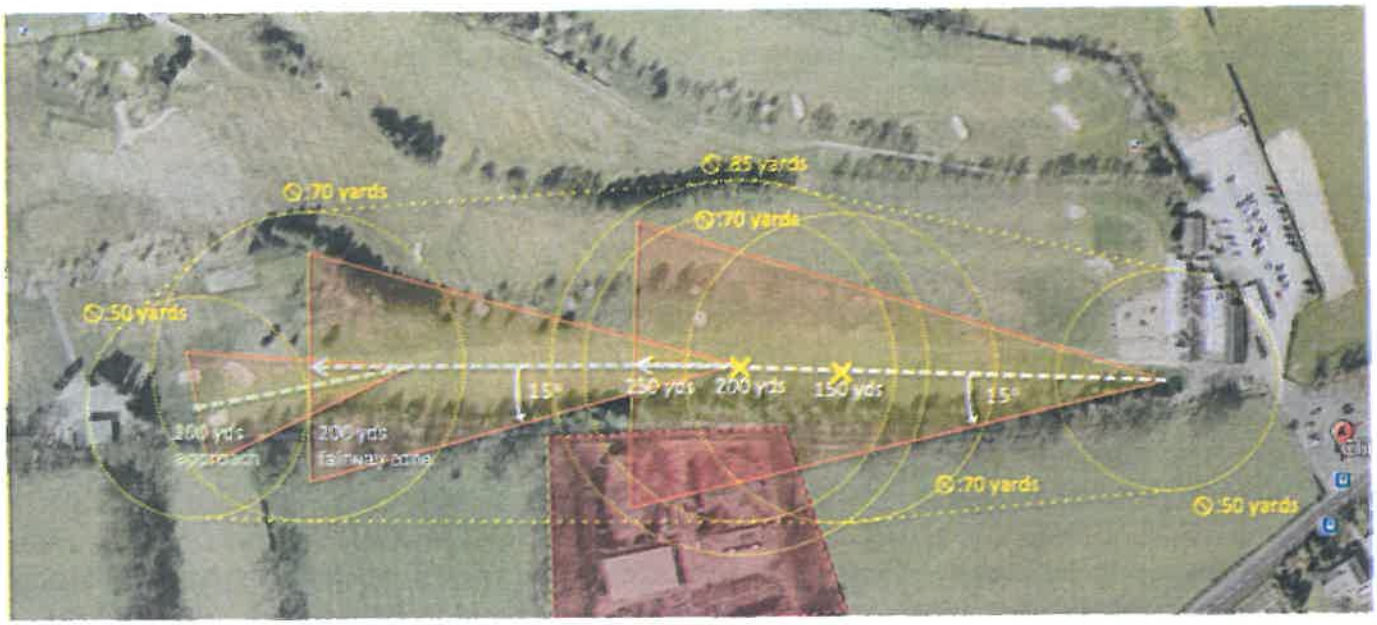
Recommendations

- Continued monitoring of the number of balls struck out of bounds from the 1st tee should continue.
- Measures the club has introduced, to encourage golfers to play more conservatively from the 1st tee, could be strengthened and the impact assessed: -
- The boundary line is positioned along the track, to the left of the trees lining the fairway. The club could consider moving the boundary line to the right of the trees, making it more visible.
- The rough down the left hand side could be allowed to grow longer.
- Additional hazards, such as fairway bunkers, could be constructed down the left hand side. If these are visible from the tee, they could encourage golfers to play shorter and aim further right.
- In order to significantly reduce the number of balls being struck out of bounds and into the adjacent properties on the new Morris Homes Ltd. housing estate planning permission should be sought to erect a fence or netting along the boundary.
- Given the close proximity of the properties to the boundary line, the fence should be as close to the boundary line as possible and at least the height of the guttering on the properties closest to the boundary; those at most risk.

- Taking into consideration the distances golf balls will travel, particularly from the 1st tee, and the likely trajectories, a fence approximately 5 to 6 metres in height should prevent the vast majority of balls from directly entering the adjacent properties or striking the sides of the houses, windows, patios etc., causing damage or injury.
- Whilst there may be a small residual risk of balls being struck over the fence, these are most likely to be slowed by the tree canopies along the boundary and/or strike the roofs of the adjacent properties. This will result in the balls slowing down to such an extent that they should cause only limited damage.

Observations

Diagram showing the location of the housing estate and proximity to the 1st hole.



(Unfortunately, Google Earth has not yet been updated to show the completed housing estate, which is located in the red shaded area.)

Likelihood of balls being struck towards the housing estate.

The diagram above shows a typical zone, into which tee shots from the 1st tee of up to 250 yards are played. The zone assumes a 15° angle of error; this equates to tee shots that are struck 200 yards, being up to 54 yards wide to the left or right. Research, detailed in the appendix to this note, has shown that 96% of golf shots will fall within this zone. The remaining 4% are considered "erratic" and could be struck outside the 15° zone.

The yellow envelope broadly represents the area into which it is physically possible to strike a golf ball, therefore taking into account both wayward and errant shots.

Clearly, the main area of concern is the area of the housing estate, which clearly falls within the 15° zone and that is therefore within reach of wayward shots. The available statistics do not allow us to be any more accurate, but it is reasonable to estimate that somewhere between 2% to 5% of all tee shots played from the 1st tee will be struck towards the housing estate.

Based on a conservative estimate, that an average of 150 rounds of golf are played per week, or 7500 rounds per annum, it is reasonable to expect that approximately 150 balls per annum will be played towards the housing estate; representing 2% of tee shots from the 1st tee.

Severity of damage or injury

The potential damage caused to property or personal injury can be significant. Typical golf ball speeds are approximately 110 to 130 mph at the point of strike and in excess of 50 mph after approximately 200 yards. *(Based on U.S. Trackman data 2012)*

Homeowner actions

Homeowner actions since taking residence have significantly reduced the effectiveness of all of these safety measures. Their actions have increased the risk of golf balls entering their properties, at speeds that could cause damage or injury.

- The Leylandii hedge has been cut down.
- Mature trees along the course boundary have been thinned or felled.
- The mature hedgerow along the boundary (shown in the photos below) has been removed.
- The fence height has been lowered to approximately 5 feet.

Additional control measures affected by Clitheroe Golf Club

It is important to note that Clitheroe Golf Club were not consultant during the assessment alluded to in the Planning Statement extract above, undertaken by Morris Homes Ltd.

The club has been concerned that the risk of golf balls entering the new properties has been underestimated by Morris Homes Ltd. and has established contact with homeowners, who have reported a significant number of incidents of golf balls entering their properties.

As a result, the golf club has undertaken a number of control measures, to try to reduce the number of balls being struck into the properties. These have mainly focused on encouraging golfers to play their first tee shot more conservatively, by adjusting the risk/reward of trying to play long tee shots, aiming to the left of the fairway. These include: -

1. Re-angling the tee, to encourage golfers to aim further right.
2. Pushing the out of bounds line further to the right and clearly marking it with a row of visible white posts. This would typically encourage golfers to play more conservatively, as they would not want to lose a ball with their first shot.
3. Growing the rough down the left hand side of the fairway.

Monitoring

Continued monitoring, to assess whether these measures have successfully reduced the number of balls being struck towards the properties, has been undertaken. However, the conclusion has been that the impact of these measures has not been significant enough and that too many balls are still being struck towards and into the adjacent properties.

At the time of writing this assessment, there has been an incident of property damage to one of the properties along the course boundary, resulting from a wayward tee shot.

As a consequence of the limited effectiveness of the club's current measures, combined with the actions of the homeowners in reducing the effectiveness of the existing protective barriers, the club remains concerned about the risk of significant damage or injury being sustained.

At such velocities, a direct strike will cause significant property damage or injury to persons.

Therefore, with approximately 150 occurrences of potential significant property damage or injury per annum, consideration must be given to introducing control measures to reduce the number of balls being struck towards the course boundary and to slow balls down, before they cross the boundary.

Control measures

Before the development of the housing estate, the following measures provided a significant barrier to wayward and errant golf balls being played towards the garden centre, which previously occupied the site: -

- The trees along the course boundary were mature, dense and relatively tall.
- A row of Leylandii trees and a dense hedgerow, along the boundary between the clubband adjacent property also afforded protection from low struck shots.

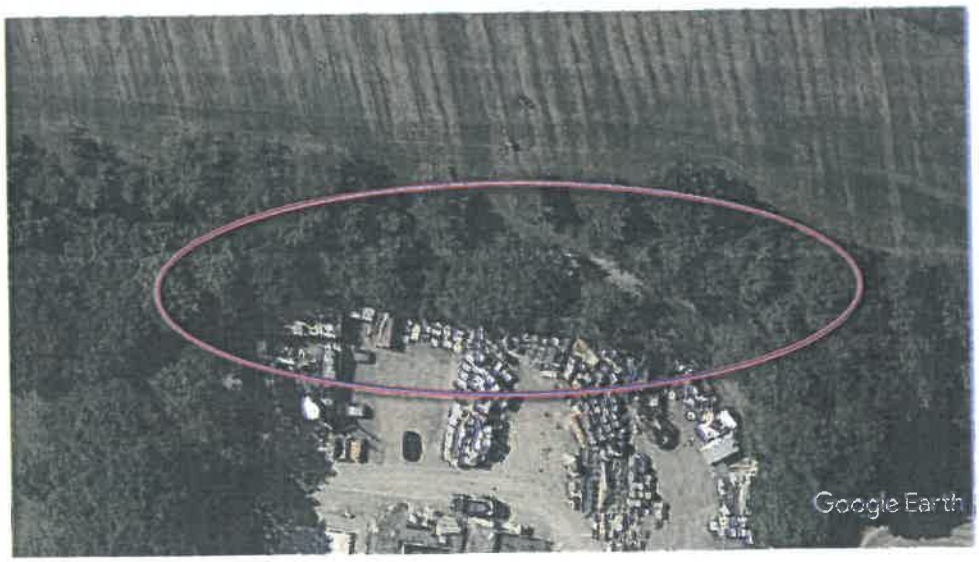
Had these natural barriers been maintained, whilst they may not have prevented balls from entering the new residential properties, they would certainly slow golf balls down to a speed much less likely to cause significant damage or injury.

It is worth noting that this was recognized in the Planning Statement, produced by Frost Planning on behalf of Morris Homes Ltd. in August 2016.

"6.6 Golf Balls (Condition 15)

The design of the development will ensure that future residents will not be put at significant risk of being hit and injured by misdirected golf balls. Our client has assessed the level of risk and considers it to be negligible given the likely very low frequency, trajectory, and velocity of any golf balls reaching residential properties. It is inevitable that the vast majority of stray balls will be prevented from landing in residential properties due to the natural screening effect of mature trees along this boundary. Furthermore, the layout of the scheme ensures houses and their gardens are of a sufficiently safe distance and orientation to limit the risk of injury or indeed damage to property."

The Google Earth image below, captured on 28/6/2018, clearly shows the extent of the original natural barriers.



In addition to the natural barriers, Morris Homes Ltd. also erected a solid wood fence along the boundary. It is unclear whether this was to provide protection to the properties from balls. However, the fence was approximately 8 feet high, which protected the properties from low struck golf balls, which could fly below the tree canopies and into the properties.

Appendix: Unintentional, wayward shots - Proximity Assessment

With limited information and research into the driving distances and shot distribution of the average club golfer, the traditional approach is to apply standard golf design 'rules' and then look at any mitigating circumstances to determine if a particular hole poses a risk to other holes, footpaths or adjoining properties.

***"Betzler, N. F., Monk, S. A., Wallace, E. S. & Otto, S. R. 2012 Variability in clubhead presentation characteristics and ball impact location for golfers' drives"* is the only published study of real relevance that examines shot distribution from a sample of amateur golfers and was published in the Journal of Sport Science 30, 439-448.**

The study examines the shots hit by amateur golfers representative of a typical club. The study and data collected examines the scatter of average golfer shots hit by 62 amateur golfers representative of the normal mix of abilities found at most clubs. They hit a total of 269 driver shots at a driving range and the results were monitored using Doppler radar tracking. The study provides the best indication of the splay of shots available in a scientific form. The authors have commented that although the study relates to only 269 hit shots, they would not expect a significantly different spread, were the study to have used a larger sample data set.

Obviously, golf is a highly variable game where wayward and errant shots can occur but this data is the most reliable available, from which to construct an objective assessment approach.

Please refer to the diagram on the next page. Standard golf design rules are shown with an internal green cone at 7.5^{O} either side of the aiming point and an outer black cone at 15^{O} either side of the aiming. The circle represents a 60m radius at 260m, (282 yards) that should not overlap any external boundary. The majority of drives at an average members club would be expected to land in the 200 - 240 yard zone with the low handicap amateurs more likely to fall within the 240 - 280 yard zone.

A ball scatter diagram, as collected by the research carried out in the study described above is also depicted. The colours represent the different handicap groups tested as follows:

Blue - 0-6 handicap Red - 6-12 handicap Orange - 12-20 handicap Grey - 20+ handicap

It shows that on average there are more shots hit to the right than to the left and also that the better golfers are not only longer but also straighter.

The diagram illustrates the two other studies overlaid on top of each other. While there is good correlation between the two approaches studying it in more detail reveals that more shots are likely to go to the right of the intended target and that the golfers that are capable of hitting longer shots are also more likely to be more accurate so an ever expanding cone may not be the most appropriate shape.

What was clear form this research was that only erratic shots are hit wider than 15^{O} and represent a very small proportion of the overall shots played.

Diagram showing the combined approach of the 15° zone and shot scatter patterns.