FLANDERS PLAYING FIELDS – BOUNDARY RISK ASSESSMENT

CLIENT	Newlands Developments
SITE ADDRESS	Rockingham Cricket Club Sheffield Road Barnsley S74 0DQ
CLIENT CONTACT	David Henshaw

REPORT NUMBER	LSUK.20-0564	
REVISION NUMBER & DATE	1.0	10/09/2020
REPORTED BY		George Thorne Site Engineer
APPROVED BY		David James Managing Director

SUMMARY	To assess the potential risk of cricket balls surpassing the boundaries of a cricket pitch at Rockingham Cricket Club towards a planned new road, Labosport Ltd has reviewed the site including distances to ascertain the risk of balls landing in areas past the boundaries; and advise on the type and level of mitigation recommended to provide a suitable level of protection. This report forms the basis of a risk assessment, and if required, a recommended mitigation strategy to minimise potential risks.

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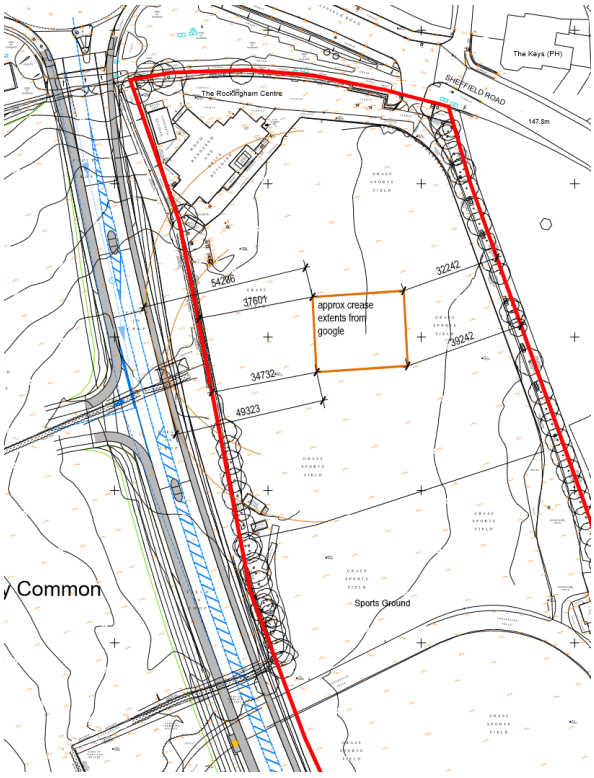
INTRODUCTION	To assess the potential risk of cricket balls surpassing the boundaries of a cricket pitch at Rockingham Cricket Club towards a planned new road, Labosport Ltd has reviewed the site including distances to ascertain the risk of balls landing in the adjacent areas and advise on the type and level of mitigation recommended to provide a suitable level of protection. Mitigation options taken into consideration where applicable include; fencing, location and orientation of the cricket square and wickets, player ability, location of junior and senior wickets, and development type. Using a ball projectile model and supporting data from research undertaken, based on professional level cricket, by Labosport for the England and Wales Cricket Board (ECB) the following risk assessment has been produced. As with any model and sensible risk assessment, the proportionality linked to risk (comprising likelihood and severity) are included in this report. Note: This is a desk study, Labosport have not visited the site, taken measurements or carried out a visual inspection. This assessment is undertaken on the basis of accurate data and all measurement information has been provided by the client. Any errors in measurements are not the responsibility of Labosport
SITE SPECIFICS	The below diagram illustrates the layout of the cricket square and surrounding boundaries. The wickets are orientated in a North to South direction. The client has requested one area for the boundary risk assessment; the West orientation. In this orientation there is the boundary of the cricket field and the boundary of the planned new road. The location of the potential mitigation is unclear, and therefore a number of scenarios are considered. The client informed Labosport during the site visit that the second square has plans to be extended with more wickets in the west direction. **Site Measurements** 

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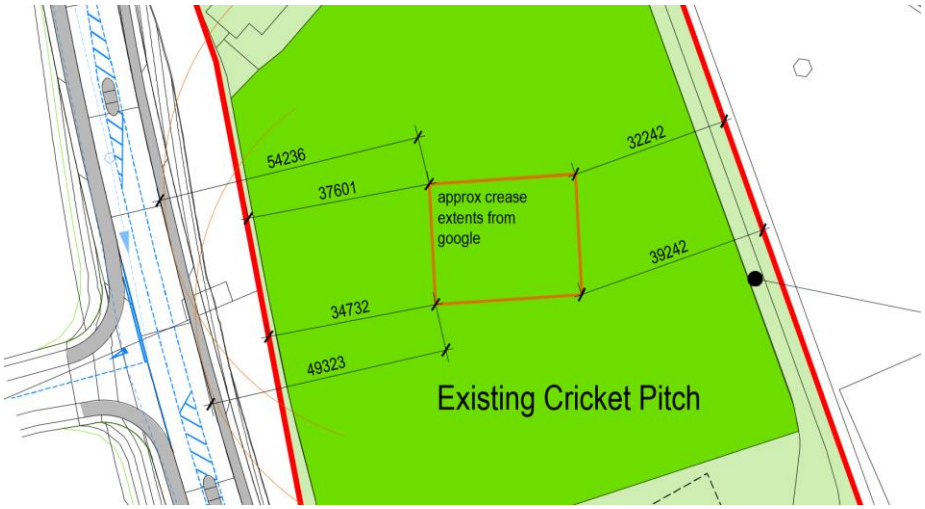

Orientation of Risk

The focus on the boundary assessment is based on the shortest distances from the edge of the cricket square to the boundaries/location of any mitigation and hence worst-case scenario.

SITE MEASUREMENTS

The above diagram illustrates the minimum measured distances from the cricket square to the proposed mitigation locations. Note as this is a risk assessment the worst-case scenarios are considered; consequently, the shortest measured (and calculated) distance is used for the study.

Measured Distance	Shortest Boundary (m)
West – Edge of the cricket square to the boundary of the playing facility	Circa 34.7 m
West - Edge of the cricket square to the boundary of the proposed road	Circa 49.3 m

ESTIMATED BALL HEIGHT (USING THE PROJECTION MODELLING TOOL)

Previous work undertaken for the England and Wales Cricket Board (ECB) led to the development of a model that is used to estimate the distance a ball would travel, and its trajectory given a specific initial velocity and angle.

Model limitations

The trajectory model uses aerodynamic principles and Newtonian physics to predict the ball flight path. The trajectory model accounts for the ball size and mass, the ball's drag coefficient and the effect of air resistance, and the force of gravity. The trajectory model does not account for variations in bat/ball restitution, atmospheric conditions, wind (speed and direction) or the spin of the ball. Due to these limitations, the model is regarded as an indicative prediction tool.

The below table highlights the total estimated distance a ball will travel for typical shots (angles and velocities) taken from assessment of in-game action ranging from 20 degrees to 50 degrees and 20 m/s (45 mph) to 50 m/s (112 mph).

Total Estimated Distance (m)		Angle (degrees)						
		20	25	30	35	40	45	50
Velocity (m/s)	20	20.70	23.24	25.82	27.22	28.04	27.84	27.10
	25	28.82	32.8	35.29	37.01	37.95	37.66	36.25
	30	37.32	41.99	44.91	46.31	47.34	46.51	45.27
	35	45.95	50.48	53.80	55.40	55.96	55.04	53.15
	40	53.71	58.79	61.82	63.62	63.73	62.73	60.24
	45	60.50	66.15	69.52	70.93	70.62	69.17	66.53
	50	67.88	73.23	76.29	77.88	77.15	75.62	72.09

Note: the trajectory for the above distances will be very different depending on the angle and velocity of shot as can be seen in the assessment below.

The hit angles and velocities are estimated from in-game action to cover a range of 'typical' shots ranging from 20 degrees to 50 degrees and 20 m/s (45 mph) to 50 m/s (112 mph).

The following distances have been used to calculate the height of the ball for different shot conditions as specified below:

Measured Distance	Shortest Boundary (m)
West – Edge of the cricket square to the boundary of the playing facility	Circa 34.7 m
West - Edge of the cricket square to the boundary of the proposed road	Circa 49.3 m

West Orientation; Playing Boundary

Estimated Ball Height @ 34.7 m		Angle (degrees)						
		20	25	30	35	40	45	50
Velocity (m/s)	20	0	0	0	0	0	0	0
	25	0	0	1.7	3.4	4.5	5.0	4.6
	30	2.0	4.4	6.8	9.3	11.6	13.6	14.8
	35	4.6	7.4	10.1	13.0	15.8	18.7	21.2
	40	6.3	9.3	12.3	15.4	18.6	22.0	25.4
	45	7.6	10.6	13.7	17.1	20.5	24.3	28.2
	50	8.4	11.6	14.8	18.0	22.1	25.9	30.4

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West Orientation; Proposed Road Boundary

Estimated Ball Height @ 49.3 m		Angle (degrees)						
		20	25	30	35	40	45	50
Velocity (m/s)	20	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0
	30	0	0	0	0	0	0	0
	35	0	1.8	4.6	6.9	9.2	9.5	8.7
	40	2.8	6.3	9.9	13.3	15.9	18.4	19.1
	45	5.8	9.8	13.7	17.4	21.0	24.1	26.4
	50	8.1	12.1	16.2	20.4	24.5	28.5	31.9

See Appendix A for example trajectories.

RISK ASSESSMENT DISCUSSION

This report has been prepared to assess the potential risk of cricket balls surpassing the boundaries of a cricket pitch at Flanders playing fields and advise on the type and level of mitigation recommended to provide a suitable level of protection. Mitigation options taken into consideration where applicable include; fencing, location and orientation of the cricket square and wickets, player ability, location of junior and senior wickets, and development type.

The exact frequency of shots resulting in a cricket ball being hit into the adjacent area is unknown and impossible to predict with certainty (player skills, type of game and many other factors can influence this), hence a proportionate approach needs to be taken to provide safety to individuals within the vicinity of the facility. In reality there may be a "freak" shot that will result in a further than expected trajectory; however, the implications of planning for this type of worst case approach would result in the closure of hundreds of cricket grounds across the country hence a balanced risk mitigation strategy needs to be implemented that is proportionate. Indeed, there are risks associated with many everyday activities, but plans need to be developed to reduce risk following good practical health and safety principles including a combination of likelihood and severity.

Labosport Ltd have undertaken this type of assessment for other cricket grounds over the past 4 years when there have been perceived problems with cricket balls exceeding the boundary or the influence a new development may have on an existing club.

An initial shot velocity of 50 m/s is used for professional (1st class and international) players. Typically for recreational cricket clubs, we undertake the assumption that 40 m/s is a suitable initial velocity given the reduced speed of bowling and batsman's skill when contrasted with elite players. The ECB have specifically requested that a shot velocity of 45 m/s is considered for this risk assessment and it is on this basis that the below recommendations have been made.

Risks Overview/Mitigation Approach – West Orientation; Playing Boundary

The shortest distance from the edge of the cricket square to playing field boundary in the West orientation is 34.7 m. At 34.7 m all but the fastest shots at the prescribed level of cricket will be stopped by a 24.0 m high mitigation system. A 24.0 m high system will not stop all shots from landing beyond the boundary, but it is believed from the assessment of ball trajectory it will significantly reduce their frequency. In order to almost completely remove the risk of cricket balls landing in the area beyond this boundary a mitigation system of 30.0 m high would be required.

Based on the height calculations of the ball trajectory combined with the experiential information regarding shot scenario, direction of play and site specifics, a mitigation system 24.0 m high at the shortest distance to the boundary is recommended. This may not stop all shots from landing beyond this boundary, but it is believed from the assessment of the ball trajectory, it will significantly reduce their frequency.

Risks Overview/Mitigation Approach – West Orientation; Proposed Road Boundary

The shortest distance from the edge of the cricket square to proposed road boundary in the West orientation is 49.3 m. At 49.3 m all but the fastest shots for the prescribed level of cricket will be stopped by a 25.0 m high mitigation system. A 25.0 m high system will not stop all shots from landing beyond this boundary, but it is believed from the assessment of ball trajectory it will significantly reduce their frequency. In order to almost completely remove the risk of cricket balls landing in the area beyond this boundary a mitigation system 31.0 m high would be required.

Based on the height calculations of the ball trajectory combined with the experiential information regarding shot scenario, direction of play and site specifics it is recommended that a mitigation system 25.0 m high at the shortest distance to the boundary. This may not stop all shots from landing beyond this boundary, but it is believed from the assessment of the ball trajectory, it will significantly reduce their frequency.

Further notes:

This report does not recommend the specific design of a mitigation system, however options could include;

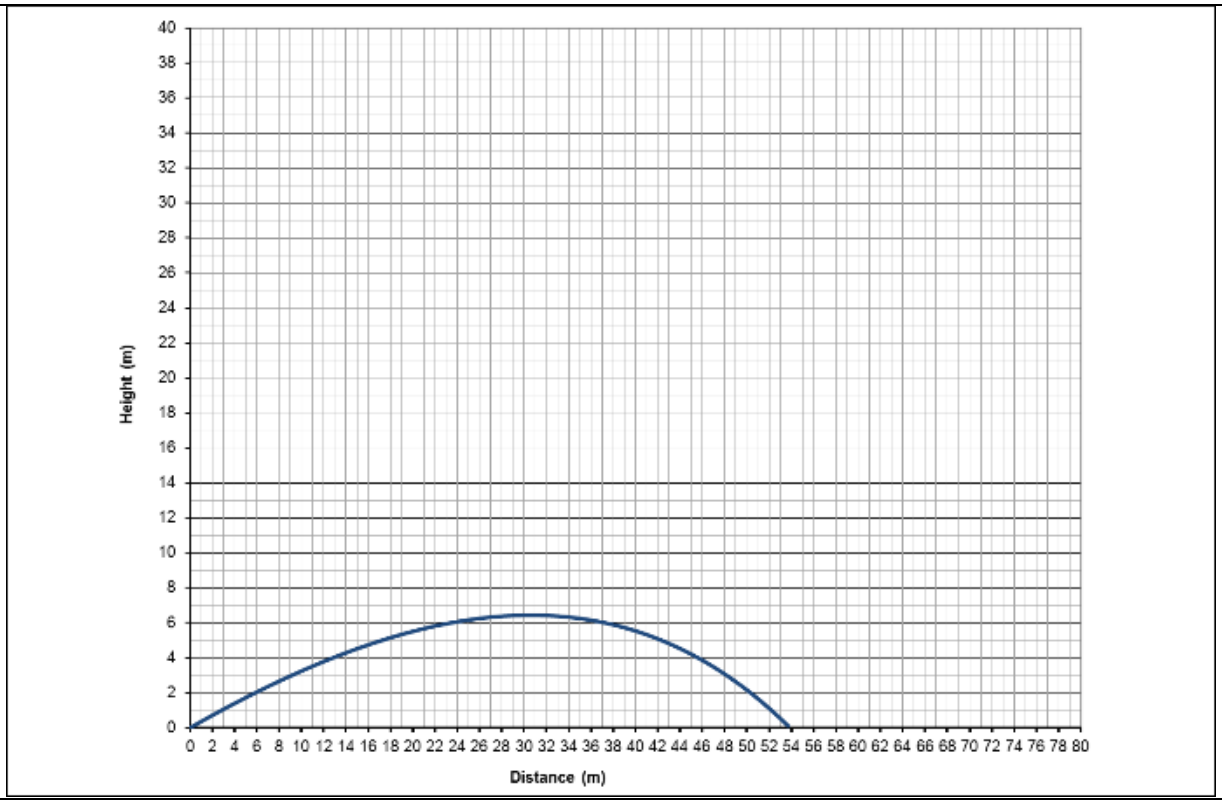
- Ball stop netting
- Permanent or temporary fencing structures

It is recommended the client discuss design options with the relevant stakeholders including the LPA, Sport England, the ECB and the cricket club.

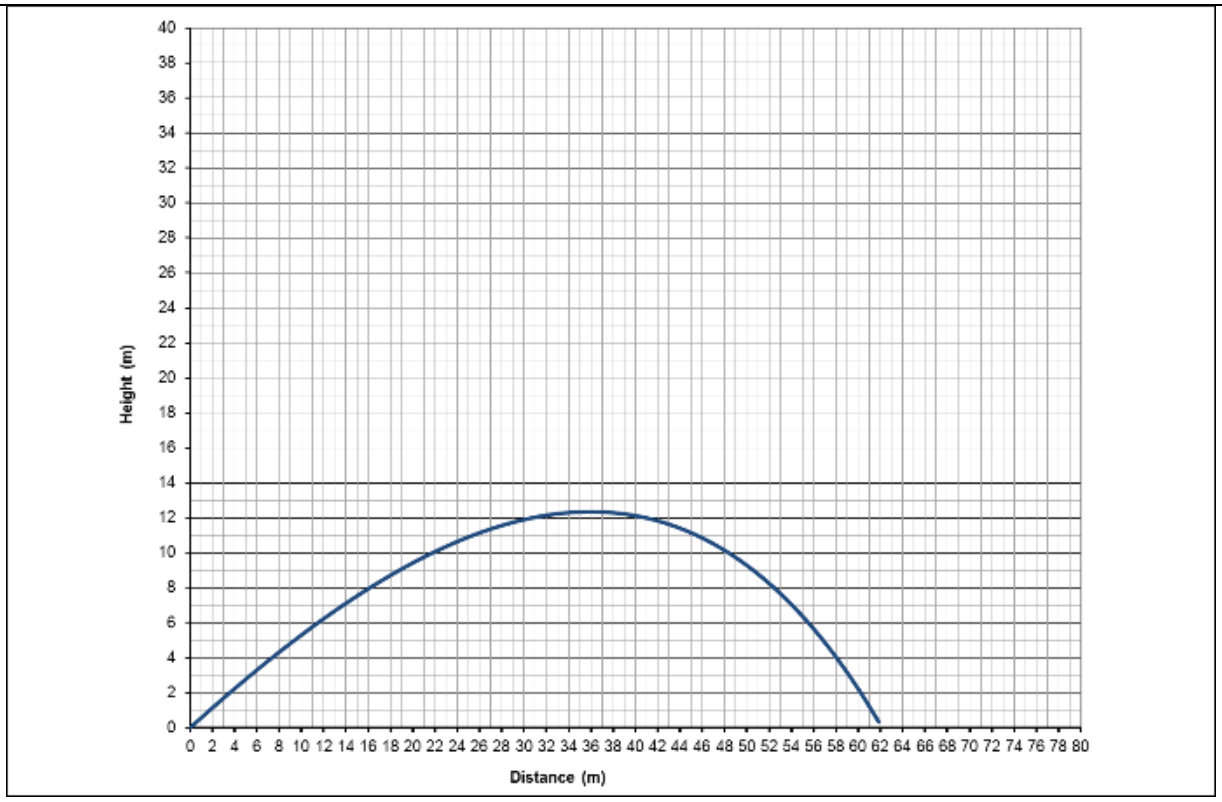
It is recommended the client discuss the plan with the England and Wales Cricket Board (ECB) or other relevant organisations such as Sport England along with the club to ensure whatever system if proposed is both suitable in mitigating the risk but also practicable for the cricket club's day to day use.

APPENDIX A – TYPICAL EXAMPLE TRAJECTORIES

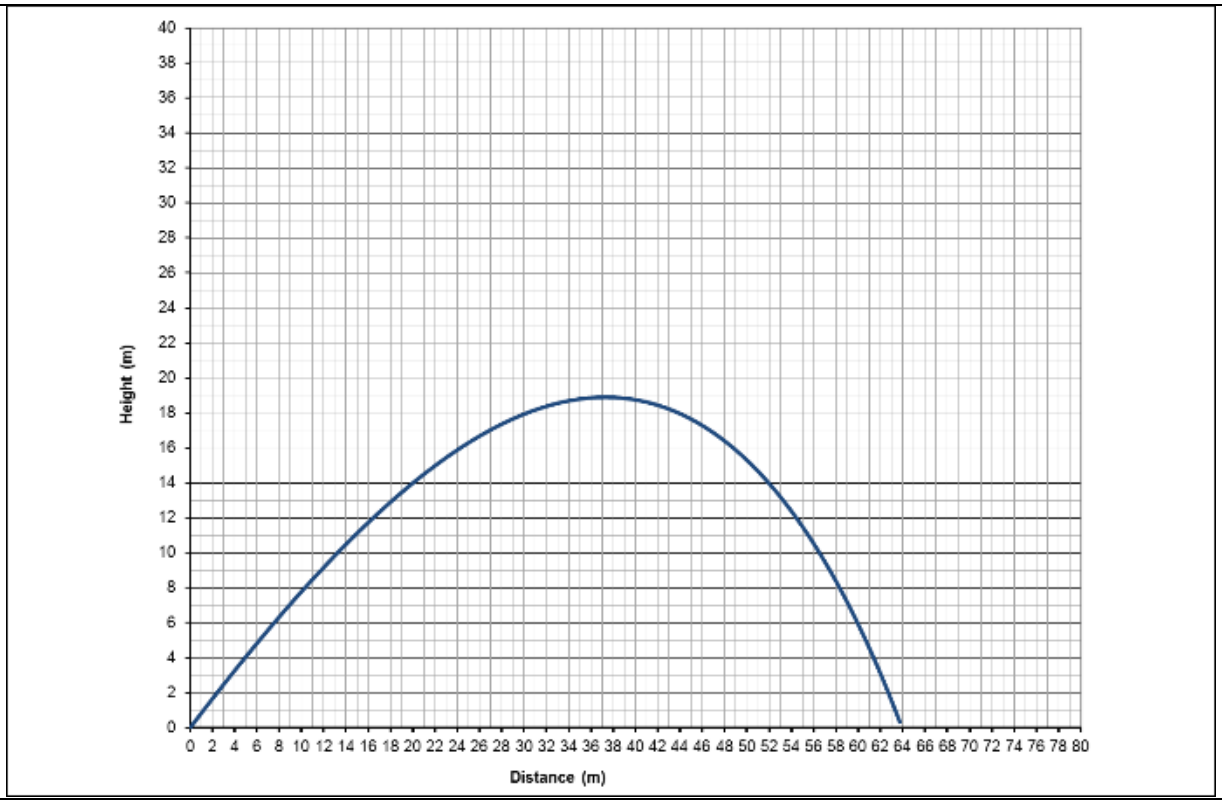
20 ° @ 40 m/s



30 ° @ 40 m/s



40 ° @ 40 m/s


Height (m)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
Distance (m)
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80