Fitness for Purpose

Evaluation of Stables in Current Use in the UK

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Glossary of Terms

Stable	Building used to accommodate horses. Refers to a subdivided building with a main doorway **or** an individual accommodation unit where a horse is loose (not secured) with a separate external access. Also referred to as a loose box or simply a box.
Stall	Separate unit where individual horse is kept within building, having access internally within the building. The horse will remain secured within the stall and be unable to turn around. Uncommon today except in urban situations.
Agonistic	Struggle or competition, combative argument.
American Barn	Barn with stables and/or stalls on each side opening onto a central corridor.
Automatic waterer/bowl/system	Gravity fed watering system utilised in stables to replace the use of manually filled water buckets.
Banks	Raised area of bedding around the stable wall to reduce the chance of the horse getting cast.
Bedding	Material utilised within the stable for the horse to stand and sleep on.
Cast	Horse unable to rise in stable due to position in which it is lying.
Conversion	Building utilised as stabling but not originally built as stabling/to house horses.
Design	For the purpose of this study the word “design” will be

	interpreted to include the functional layout of the stabling facility as a whole, the functional layout of the individual stabling provision and also the construction and building materials utilised within the stabling facility.
Harness (room)	Room where harness for a coach/carriage horse is kept.
Hayrack	Wall rack for the feeding of hay.
Heave line	A line of abdominal muscle which develops due to effort exerted to breath.
Historic	For this purpose this will refer to time prior to the end World War I November 1918 (Armistice).
Horse walker	Mechanical means of exercising horses: (similarity to motorised rotary clothes line within a circular fence).
Hospital box	Stables utilised for the care of sick horses. More commonly found in large stabling facilities.
Indoor school/arena/"riding house"	Building utilised for the exercising of horses.
Lateral recumbency	The position in which the horse is laying on its side (either left side or right side).
Manger	Wall trough for the feeding of feed such as oats etc.
Modern	For this purpose this will refer to time post the end World War I November 1918 (Armistice).

Paradoxical sleep	Also referred to as Rapid Eye Movement (REM) sleep, and active sleep. The stage of sleep when the body muscle becomes relaxed but the brain is active.
Pund	Square stone walled structure with internal divisional walls found on Shetland Isles for management of Shetland ponies.
Roarer	Horse which makes noise in the throat when exercised. Said to be roaring.
Stable “vice” e.g.	Undesirable behaviour exhibited in stabled horses: Weaving - Rocking or moving from side to side in agitated manner; Crib biting - Biting horizontal surface, for example top of stable door; Wind sucking - Grabbing horizontal surface with teeth and drawing air into stomach.
Sternal recumbency	The position in which the horse is laying down with the legs tucked underneath the body.
Tack/Saddle (room)	Room where saddles and allied equipment (tack) for riding horses is kept.
Time Budgets	Study to determine how a horse spends its day.
Trevises	Stall dividers. A division to divide a stable into a number of stalls

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Abstract

The UK has an estimated 988,000 horses, many of which are stabled as a standard management practice. Stables are a building, buildings, or a portion of a building that are used for the housing and feeding horses, cattle and other domestic livestock. For the purpose of this thesis, cattle and other domestic livestock will be excluded.

Today, horses in the UK are stabled in a variety of accommodation, including purpose built historic and modern stables, and stables integrated into buildings converted from an alternative use. This raises concerns considering the physical and psychological wellbeing of the horse, and associated management practices, resulting in the research question: Are stables fit for purpose for the modern Equidae?

The research aimed to explore and investigate the concept of suitability – Fit for Purpose of stabling currently utilised within the UK in order to formulate a revised Fitness for Purpose framework which stabling can be assessed against.

The research takes a pragmatism philosophy, with a combined deductive and inductive approach utilising cross sectional time horizon case studies with triangulated mixed methods research techniques. Multiple case study fieldwork sites were selected to demonstrate extreme, unique, typical and representative examples enabling conclusions to be holistic, representative across all stables and embedded, representative of the sub-units studied.

Data was analysed against age, number of horses, type of horse, dimensions, floor area and wall length, Fitness for Purpose, construction attributes, and social interaction and free exercise

The research revealed significant questions concerning stable size and also opportunities for Social Interaction and Free Exercise, thus overall Fitness for Purpose. A Fitness for Purpose framework for future use was developed, along recommended strategies that could improve stabling in current use.

The contribution to knowledge concerned a number of areas: the holistic literature review; practical case study field work; case study data analysis (stable accommodation utilised by the modern Equidae, and the level to which this accommodation is Fit for

Purpose for the Modern Equidae housed within it). The Revised Fitness for Purpose Framework is a vital contribution to knowledge aspect of this research.

Keywords:

Fitness for Purpose; Modern Equidae; Stable Design; Stable Evolution; Stable Management.

Clarification of "Stable"

For the purpose of this thesis, the term "stable" will refer to all individual accommodation units with a separate external access where a horse is loose (not secured).

Building or stable building will be utilised to refer to a building containing stables and/or stalls.

Stalls will be included within the thesis as they are utilised as horse accommodation within a number of the case study sites, and are necessary for inclusion within the study to reflect the evolution of horse accommodation over time.

Dedication

This thesis is dedicated to both Aramis, and Ben (Benjamin Twinkle Toes) who are both sadly missed, but will never be forgotten.

Also, to Kitty – for the constant purring.

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The big question is – what shall I do next?!

Chapter One
Introduction

1.1. Background of the study

Inspiration for this PhD followed a lifelong interest in horses, both as a leisure activity and an educational career lecturing and course managing Further and Higher Education equine management students, and thus being involved with the latest equine research and management best practice. This, combined with the valuation of landed estates, generally with a historic stabling element resulted in the inspiration to combine the elements, and investigate if stables in current use in the UK are fit for purpose for modern Equidae.

The horse is an iconic creature within the UK, depicted within the landscape as historic drawings at Uffingham, Oxfordshire and Kilburn, Yorkshire, and in popular literature including Anne Sewell's Black Beauty telling the story of a Victorian horse who experiences mixed fortunes, and more recently War Horse by Michael Morpurgo telling the story of a horse sent to the front in World War One.

On a commercial level, the horse may have declined in number since the industrial revolution where its use within the transport network, working as a cab or carriage horse, pulling a stage coach or working within the rail or canal network, or within agriculture or industry is no longer paramount (Powell, 1991, Gray, 2001), though its use in the commercial sector is still apparent by its utilisation by a number of police forces and also within the racing industry and riding schools which supports the leisure interests of many riders without their own horses and ponies.

The increased use of the horse within the leisure industry has in comparison been continuous, it being estimated that 3.5 million people (British Horse Society, 2012) have ridden a horse within a 12 month period, calculated as 6% of the UK population, though unfortunately a figure for regular riders, who may own their own horse or ride at a riding school is not available (British Horse Society, 2012). Estimated horse numbers in the UK equate to 988,000, with the average horse care costs estimated at approximately £3,000 annually and indirect consumer expenditure being in excess of £550 million, thus emphasising the extent of the equine industry within the UK (Cousins, 2004).

The manner in which horses are kept today covers a wide spectrum of facilities, from the natural management of the horse kept at grass, to the horse who has very limited or no turn out facilities and is managed in a purely stables environment for whatever reason (Kiley-Worthington, 1997, McBane 1992 and Houghton Brown and Powell Smith, 1989). Stables have been built or evolved taking into account many factors: such as the reason for the initial build occurring; the expectations and requirements of the people involved (owner, designer and builder); and consideration for the site, space, lack of space and if a previous building is to be utilised and converted, and if so how this is to be managed (Peters, 2003, Powell 1991, Scotts, 2009, The Stable Company, 2009a, and Redmire, 2009).

All the aspects above are relevant regarding if stables in current use do meet the requirements of the modern horse, and were evaluated, and utilised to produce a framework to assess currently utilised facilities against, to determine if they are fit for purpose.

1.2. Rationale and Justification

The factor of the changing use of the horse (Powell, 1991) and of stable facilities evolving (Worsely 2004), or not evolving has resulted in historic stabling that was initially designed and built for a certain type of horse, managed in a certain way, currently being utilised for a different type of horse managed in a different way (Powell and Jackson, 1992). Stables are constantly being built and/or altered (Houghton Brown and Powell Smith, 1989, The Pony Club, 1988, and Canning, 1991) equine research is constantly developing in terms of health care and management of the horse (Harris, 1999, Pederson *et. al.* 2004, and McCall, 2004), but little of this appears to be reflected in equine literature, or in the recommendations concerning the design of either new stable projects or stable conversions, thus resulting in the aim of the study, to investigate whether stables in current use in the UK are Fit for Purpose for modern Equidae (horses, ponies, donkeys and their hybrids) and thus the research question – Are stables fit for purpose for the modern Equidae?

Subsidiary questions to the research question have been developed:

- What are the welfare requirements of the modern Equidae?
- How has the stable evolved?

- What are stables in current use like?
- Do stables in current use meet the requirements of the modern Equidae, and can a framework be developed to evaluate Fitness for Purpose?

The rationale for the study was to practically study stables currently utilised for horses and relate this to the best practice synthesised from the available literature, and thus answer the research question.

The justification for the research relates to the development of horse management and veterinary care and the evolution of stables, to produce valid conclusion as to whether, with the evaluation of the primary and secondary research, stables in current use meet the expected requirements of the horses stabled within, and therefore if they are actually fit for purpose, or not.

Further, the study determined the production of a Fit for Purpose framework, enabling stables in current use to be evaluated against structured parameters.

The importance of the study is confirmed by Dr Paul McGreevy, of the Veterinary Science Department, the University of Sydney as being “a really important piece of work” (McGreevy, 2010).

1.3. Aim and Objectives

The aim of the study is to investigate whether stables in current use in the UK are Fit for Purpose for modern Equidae (horses, ponies, donkeys and their hybrids).

The research question, and subsidiary questions to the research question have been developed, as listed 1.2. above, and formulated into the objectives of the study as follows:

- Analysis of welfare requirements of the modern Equidae
- Analysis of evolution of the stable in the UK
- Evaluate the fitness for use of stables for the modern Equidae in the UK
- Evaluate the fitness for purpose of stables and provide a framework for future use

1.4. Research methodology

1.4.1. Methodology

The research question 'Are stables in current use fit for purpose for the modern Equidae?' was selected to allow for a comprehensive study into the stabling provision that exists today within the UK. The study took into account a cross section of research sites across a restricted geographical area (The East, South East and London) to allow for urban and rural, and commercial and leisure premises to be investigated.

The research question enabled a unique research study investigating primary and secondary research concerning stable management best practice and stabling facilities in current use.

The primary research formulated a unique study into the stabling provision currently utilised, which has not been undertaken within any other study. Taking into account the estimated number of horses within the UK, the primary research produced unique data concerning the manner in which these Equidae are housed.

The primary research was undertaken at a variety of research sites to enable stabling of a range of ages, within a range of settings (urban and rural) and utilised for a variety of purposes (commercial horses and leisure horses) to be investigated thoroughly.

To undertake the primary research, case study methodology (Saunders *et. al.* 2009) was selected to achieve the aims and objectives. The case study was selected to allow to allow quantitative and qualitative data collection to allow for data to be compared and contrasted across single, and multiple sites, thus producing consistent results (Saunders *et. al.* 2009). Multiple (18) case study sites were selected to demonstrate extreme, typical and representative samples, allowing for holistic and embedded conclusions to be collated (Yin, 2009).

The research choice selected was mixed methods research (Saunders *et. al.* 2009, Smith, 1991.), allowing for triangulation of qualitative and quantitative data. Therefore, the case study sites were selected purposefully, allowing for stratified and saturated data collection and analysis (Saunders *et. al.* 2009).

The secondary data formulated a unique investigation, as no holistic literature review has been undertaken to include the evolution of the horse, management best

practice and the evolution of the stable and stable yard in respect of fitness for purpose.

The secondary research was synthesised from a variety of sources, both historic and modern to produce a detailed literary review that reflected the requirements of the research question.

The secondary research was undertaken to a large extent towards the beginning of the research process to analyse the relevant information and data to assist with both the structure and the content of the thesis and also to aid the selection of suitable primary research study sites.

Primary research was undertaken to a large extent towards the middle of the research project time period, but also that the secondary research element can continue during, and also post primary research data collection.

1.4.2. Data Collection

Data collection was undertaken utilising a variety of secondary data concerning the ;location and history of the site, and the Pilot Case Study Template (Appendix 4) as an aide memoire at each site to structure collation of the primary research.

The data collected can be divided as below:

Secondary data - Yard name, location, history, building date

Primary data - No of buildings, yard design sketch, construction, building design sketch - external, building design sketch - internal, measurements, stable size, eaves height, door dimensions, window dimensions, rain water goods, fixtures and fitting and notes.

Where permitted, photographic data was collected to illustrate specific points.

Synthesising and evaluating the primary and the secondary research enabled the research question to be investigated and valid conclusions to be reached.

1.4.3. Data Analysis

The case study data was analysed against The Fitness for Purpose criteria as adapted from the DEFRA (2006) Code as justified in Table 6.4, and further against the age of the stables, and number of horses and the type of horse, and then by each Fitness for Purpose (Table 6.4.) criteria individually.

The data was further analysed against the disaggregated headings for number of horses (Fewer than 30, 30 – 80, and Above 80), age of stables (Pre 1900, Post 1900 pre 1980 and Post 1980) and type of horse (Commercial and Non-commercial).

Further analysis included social interaction and free exercise, stable floor area and stable wall length.

From the data analysis conclusions and recommendations were produced.

1.5. Anticipated Contribution to Knowledge

This is a unique study, in many aspects; the evolution of the stable, horse management best practice, and specifically and most importantly, are the stables in current use actually meeting the requirements of the horses stabled within, being actually Fit for Purpose, or not? To the authors best knowledge there has been no similar academic study undertaken.

The investigation into the evolution of stable and stable yard design was unique in that it also investigated how the changes within stable design practices reflect the socio-economic use of the horse, thus allowing for comparisons to be made between the actual design and build and the use of the horse, both at the time of the build, and also the current use if that is different or applicable to the individual study sites.

The literature review in itself is an original contribution to knowledge, being a unique detailed review of literature concerning historic and modern texts, books, journal articles, research data and on-line sources. This is the first incidence that all these resources have been collated within a single study.

The practical case study field work is a unique contribution to knowledge as it provides practical study data concerning a variety of stable accommodation sites, across a variety of ages, numbers of horses accommodated and types of horses accommodated, in a variety of settings; rural, urban, historic, modern, commercial, non-commercial, specifically built for purpose and utilising buildings converted from a previous alternative use.

The case study data produced (Chapter Five) and the case study data analysis (Chapter Six) are both unique sources of information concerning stable accommodation utilised by the modern Equidae, and the level to which this accommodation is Fit for Purpose for the Modern Equidae housed within it.

It was expected to find that stables were only partially Fit for Purpose, and from the case study data analysis (Chapter Six) and the Conclusions and Recommendations synthesised within Chapter Seven, this expectation has proven to be correct.

The Revised Fitness for Purpose Framework (Table 7.1.) is a vital contribution to knowledge aspect of this study.

1.6. Structure of thesis

The thesis is structured into seven chapters, and is structured as follows:

Chapter One: Introduction

Chapter One provides an introduction to the whole thesis, including the background to the study, rationale and justification, aim and objectives, an outline of the research methodology, and anticipated contribution to knowledge.

Chapter Two: Literature Review: The Horse

Chapter two provides a thorough review of literature concerning the horse, including the development of the horse, social structure and time budgets, and health and management.

Chapter Three: Literature Review: The Stable

Chapter three provides a thorough review of literature concerning the stable, including the evolution of stables, the design and construction of modern stables and fitness for purpose criteria.

Chapter Four: Research Philosophy

Chapter four provides detailed information concerning research philosophy and the research methodology process of the research. It includes the aim, objectives and research questions.

Chapter Five: Case Study, Context, Content and Summary

Chapter five details the case study data collected.

Chapter Six: Case Study Data Analysis

Chapter six presents the analysis of the data collected at the 18 case study sites.

Chapter Seven: Conclusions and Recommendations

Chapter seven details the conclusions and recommendations reached as a result of undertaking the study. This includes the attainment of the aim and objectives, the original contribution to knowledge, analysis of the effect of exclusions, constraints, limitations and reservations for the reliability and generalisation of the results and recommendations, including recommendations for further study.

1.7. Exclusions

Due to the Constraints, Reservations and Limitations to the study predominantly of site visits within the fieldwork a limited number of sites will be assessed. The sites were purposefully selected to provide the widest possible sample of stabling, and also to incorporate a typical example of stabling. Stabling for Equidae was included, with stabling for all other domestic livestock excluded.

Reservations within the study include the need to access sites to undertake the fieldwork and the refusal to permit access to certain sites which may be of importance to the study. This reservation will be addressed within the triangulation of data and the limits placed upon the generalisations of the research conclusions and recommendations.

Further reservations include the level of research knowledge of those granting permission so that the fieldwork can be undertaken as required by the research protocol, and that evidence is not omitted due to distractions or interference from those granting permission, or accompanying the research visit. This issue is addressed with the Ethical Approval process of the research protocol.

The restricted geographical coverage of the study sites are perceived as a potential limitation, though the geographical range was specifically identified to provide the range of stable sites necessary to produce data that was generalised to the wider UK. The study is restricted specifically to the UK for practical study reasons.

Constraints regarding the study are minimal, with time being the largest constraint, especially where accompanied access to a site is limited to a certain time and timescale, which cannot be extended, and thus data collection has to occur within the limited timescale, regardless of if more time would be preferable in certain instances.

The inclusion of human-horse interaction, and resultant behaviour patterns have been excluded, as though are important aspects of horse management, are beyond the remit and extent of this thesis.

Chapter Two

Literature Review: The Horse

This literature review introduces a number of important and relevant factors relating to this research thesis, and progresses logically through equine evolution, social structure, and horse management, thus allowing for all-important factors to be considered prior to the fieldwork being undertaken.

The literature adheres to the research objectives, providing a framework within which the research will develop to reach conclusions.

2.1. The Development of the Modern Horse

It is necessary to describe the development of the modern horse and the social structure of Equidae prior to reviewing relevant stable and yard design to determine how the horse developed to how it is physically today and to understand the social structures which are adhered to in a stable environment that has evolved from the wild situation.

2.1.1 The Family Equidae

Clutton-Brock (1992) describes three main orders of ungulates; the Perissodactyla (tapirs, rhinoceros, and Equidae), the Artiodactyla (camelids, pigs, cattle, antelope, goats and sheep) and the Proboscidea (elephants). The Equidae (horses, zebra and ass) being the highest evolved Perissodactyla.

The ***Hyracotherium/Eohippus*** inhabited the forest regions of North America from sixty-five million years ago and was a small browsing animal with four toes on each forelimb and three on each hind limb. Development continued, with a number of branches of the family becoming extinct (***Anchitherium*** and ***Hipparion*** for example), and the ***Eohippus*** developed into the modern horse – the ***Equus Caballus*** via the ***Mesohippus***, ***Miohippus***, ***Parahippus***, ***Merychippus*** and the ***Dinohippus***. The terms ***Eohippus*** and ***Hyracotherium*** are synonymous, ***Eohippus*** being named in 1876 by O.C.Marsh, Professor of Palaeontology at Yale University, and ***Hyracotherium*** being named in 1840 by the British Palaeontologist, Sir Richard Owen (Simpson, 1961).

Equus Caballus is a grazing animal, with a single hoof on each limb, the third toe, toes one and five having disappeared, though the remnants may be the ergot and

chestnut on each limb, and toes two and four being vestigial splint bones on each limb. The bones of the toe elongated to allow fast movement, and thus swift escape from predators (Clutton-Brock, 1992).

As the family Equidae developed from the ***Hyracotherium/Eohippus*** to the ***Equus Caballus*** their diet changed dramatically. The ***Hyracotherium/Eohippus*** of the Eocene period and the ***Miohippus*** of the Oligocene period being browsers. During the Miocene period ***Anchitherium*** continued as browsers, but the others including the Parahippus developed into grazers.

To enable efficient grazing on plant material containing phytoliths (particles of silica in the cell wall) cemented high crowned teeth developed, thus enabling a long and efficient grazing. As with all mammals ***Equus Caballus*** has two sets of teeth, the milk or deciduous, and the permanent. The permanent teeth have evolved into efficient grinding teeth with a pattern of growth and wear to ensure that the teeth do not completely wear away during the horses lifetime, the horse having high crowned teeth, being that the tooth crown continues to erupt through the jaw as the teeth are worn down, until in old age the crown has been totally utilised (Clutton-Brock, 1992).

The ***Equus Caballus*** has developed across the world diversely due to geographic requirements and breeding intervention into distinct breeds and types. In the UK diversity ranged from the smallest in stature; the Shetland pony not exceeding 107cm in height and the Shire Horse being the largest averaging 178cm. Both pony and horse breeds and types range between the Shetland and the Shire in height, weight and stature with traditional native breeds such as the Shetland and New Forest pony being small and stocky in stature and the working horse breeds such as the Shire and Cleveland Bay being significantly taller but still stocky. The Thoroughbred being an example of a slighter stature breed which has influenced both pony and horse breeding to produce sports ponies and horses with increased athleticism. The average life expectancy of a horse or pony in the UK is currently 24 years, with ponies tending to live longer than horses (Hartley Edwards *et. al.*, 2008).

From the literature reviewed above it can be concluded that there has been detailed research undertaken into the development of the horse, with authors such as Clutton-Brock (1992) and Simpson (1961) providing purely historical developmental data and Hartley Edwards *et. al.,* 2008) providing more contemporary data. This corpus is of importance with regard to the research aim as the changes that have occurred have

an influence on current management practices, such as feeding and exercise regimes. These both affect the purpose of the stable and will be returned to later in this chapter.

An understanding of the development of the horse leads into the necessity to understand the social structure of the horse, so that this can be related to stable design.

2.2. Social Structures of the horse

Before a review of the relevance of stable and yard design can be undertaken, it is necessary to describe the herd social structure of the feral horse. Feral horse's exhibit four distinct types of social gathering:

1. Nomadic harem;
2. Bachelor group;
3. Territorial system;
4. Solitary male.

2.2.1. The Nomadic Harem Group Structure

The social structure of the wild horse, mountain zebra and plains zebra incorporates established harem groupings. The harem group follows an identical structure regardless of the species concerned. There is a single mature stallion, a harem of mature mares, the mares' offspring from the previous season and younger foals (Berger, 1977). The individuals in the group tend to organise themselves into a well-defined, linear hierarchy (to be expanded upon in later sections).

Following investigation into the harem size of wild horses, Kaseda and Khalil (1996) concluded that harem groups ranged from one to nine mare members, and that the harem size reduced as the stallion's age increased. Over a sixteen-year period, sixty individual harem herds were identified, and they all followed the social structure described by Berger (1977). It has been seen that the reproductive potential of the herd increases significantly with the overall size of the herd, regardless of the herd member's age, sex etc. It was concluded that the greater the number of horses, the greater the proportion of horses that reproduce, and as the herd numbers reduce in number, so does the reproductive efficiency on a linear scale (Miller, 1981).

Other examples of harem groupings can be observed in plains zebra of the savannah country from northern South Africa to the southern Sudan. Estes (1974) reported on their behaviour as they moved in their annual migrations along with the wildebeest (*Connochaetes taurinus*). He stated that they thrive in abundant numbers that remain relatively constant with no reduction in the total seen for a number of decades, unlike other wild horses.

The zebra of Southern Sudan lived in established harem groups throughout the journey, when they trekked by day, making use of the tracks and short grass for ease of travelling, though this did increase the degree of danger from predators. The zebra moved to areas of long grass at night for protection. This is the only equid seen today whose natural wild numbers have not reduced due to human intervention or environmental impact, this provides scientists with the ideal situation for equid natural behaviour experiments (Estes, 1974). The advantage of herd living becomes obvious at times of danger, as being a member of a group it is safer for the older or weaker individual, as it is harder for them to be singled out for attack by a hyena or other predator (Estes, 1974).

The harem structure developed with the young stallions being removed from the herd when they were perceived to be a threat by the mature stallion. This occurred when the stallions reached weaning age (two years) and bore no relation to bloodlines or the dam's position in the herd. Such dispersal ensured that the immature stallions did not mate with close relatives, resulting in inbreeding. These young males formed bachelor groups between being members of their maternal harem herd and forming a harem of their own. Bachelor bands contained members of a variety of harem bands and not just the rejected males from one harem band (Berger, 1977; Houpt, *et. al.,* 1978).

Bachelor band members may obtain a harem by fighting and defeating an old, weak or sick stallion and stealing his harem. Berger (1977) described incidences of these stallions being defeated in battle by a younger stallion. He also stated that this is rare as the harem stallion shows tremendous perseverance and motivation in maintaining his harem, and so is rarely defeated unless age or health has an effect.

As an alternative a harem group can develop when a member of a bachelor group steals mares individually from an established harem group. This is advantageous as it increases the gene pool further, reducing the risk of inbreeding (Klingel, 1975).

Klingel (1975) stated that stealing was the much preferred and more common means of establishing a harem group, as the danger of injury was reduced as a full scale fight does not normally ensue; provided that the thief stallion carries out the abduction discreetly, preferably under the cover of darkness.

Mares that are not abducted or stolen are either pushed out by their mothers when a new foal is born, or may leave the harem voluntarily. Monard and Duncan (1996) studied natal dispersal in feral Camargue mares on the Tour du Valat estate in south-eastern Camargue, France. The aim of the study was to address two hypotheses: that mares leave to join other harem bands with fewer mares, thereby obtaining a higher hierarchic rank than in the natal harem and that mares join a harem with the least familiar horses therefore avoiding inbreeding.

Klingel (1975) and Hoffman (1985) concluded that greater numbers of young mares were abducted or stolen rather than older mares. It was not stated if stallions did attempt to abduct older mares and were unsuccessful, or if attempts with all but young mares were fruitless. The stealing of young mares from established harems ensures that there is a constant gene flow across the horse population and this along with stallion displacement reduced the risk of inbreeding (Klingel, 1975).

Berger (1977) and Klingel (1975) stated that the incidences of harem stealing and single mare abduction occurred mostly in the spring months, at the start of the natural breeding season. Feh (1988) studied the harem structure of a herd of Przewalski horses, concentrating on the social interaction between members of the herd. It is stated that the stallion, and a mare when in season have the highest frequency of being “farthest” from the other herd members, and the lowest incidence of “being nearest” to other herd members. This results in the mare being physically on the edges of the herd, thus easier to steal than if she occupied a central position, and also more receptive to the advances of another stallion whilst in season. In contrast, during the non-breeding season established harems appear to remain stable with little internal hierarchic change, or interference from external sources.

Estes (1974) described that the dispersal of mares from the natal band did not result in the mare experiencing a lower level of aggression within the new harem than in the natal band, but that the opposite occurred. Thus, the mare received a higher level of aggressive behaviour from the members of the new band, Therefore it was unlikely that a higher rank was achieved. It was proven however that the mares moved to a

harem with one stallion and a low number (above two) of young mares, and that the mares were usually familiar to each other, though the stallion generally was not familiar to the mare. Natal dispersal following this pattern did result in the majority of the mares within the harem bands being closely related, but as the stallion was unknown to the majority of the mares and was the only stallion to mate with the mares it appeared that natal dispersal functioned to reduce inbreeding.

Abducted or stolen mares from other bands were kept at a distance from existing band mares until they had been successfully covered by the dominant harem stallion, before confirming that they were accepted into the harem. Before this time the stallion protected the mare from the other mares' apparent anger and aggression, it was stated that once successfully covered, the mare was perceived by both the stallion and other band mares as an established band member (Estes, 1974).

Monard *et. al.,* (1996) studied the effect of natal dispersal on the age at which the young mares first foaled. It was proven that natal dispersal did not delay the age at which the mares had their first, and subsequent foals, and the fatality rate of these foals was lower than for mares that remained within their harem band for the duration of their lives. It was therefore suggested that natal dispersal was advantageous for the survival of subsequent generations rather than the current young mares.

Social structure and interaction within the foal group of a harem band was studied by Schoen, *et. al.,* (1976) to assess the interactions between foals and their dams in the harem using the band kept at Cornell University, Ithaca, New York. The herd of ten foals (seven being colts and three being fillies) and fifteen mares were studied. They concluded that their play behaviour was extensive, and that mother-foal interaction was high. It was also seen that in times of danger, if a dam was not able to assist her foal to escape, another mare would help the foal to flee, or protect the foal from attack if necessary.

In the Cornell University study the harem was both established and domesticated, but the mares illustrated the natural instinct to protect the young, whether the mares own young, or the young of others. This was also noted by Estes (1974), and Klingel (1975), in the Mountain, Plains and Grevy's zebra (*Equus Grevyi*). The overall structure and dynamics of the harem group stays relatively constant throughout the various herds studied despite geographical location. This suggests that the

mechanisms in place offer significant advantages from an evolutionary and safety point (Berger, 1977., Houpt *et. al,* 1978., Estes, 1974).

From the literature that has been reviewed, it can be concluded that the harem structure functions to establish a safe environment for all the herd members, to maintain reproductive potential and finally to minimise inbreeding.

2.2.2. The Bachelor Group

Houpt *et. al.,* (1978) stated that bachelor groups were established by the young males leaving the harem group in which they were born, at approximately one or two years old. The young males may have been ejected from the maternal band by the dominant mares driving them away, by the harem stallion driving them away, or by moving further towards the edges of the band before leaving voluntarily.

The lone young males established bachelor groups, which were made up of two or more individuals of two to six years of age, with the possible addition of an older male. The older male may never have held a harem, or may have had his stolen by a younger stallion and joined the bachelor group in preference to the solitude and increased dangers of living alone (Hoffman, 1985).

Following a study of feral horses in the Red Desert, Wyoming, Miller (1981) concluded that the average male band consisted of 9.3 to 9.6 males, and that this number tended to remain constant across all the separate bands studied. Moreover Kaseda and Khalil (1997) found that even when young stallions left the harem band, they returned several times from the bachelor group and had physical contact with their dams, i.e. mutual grooming, thus indicating their attachment to the herd. Such interaction was not described by Miller (1981) who suggested that once a young male had left the harem band they did not return voluntarily, and may only associate with the harem band again if they should meet again, especially when resources were restricted and harem groups were in closer confinement than usual.

Social interaction within the bachelor band was studied by McDonnell and Haviland (1995). The study was based on daylight hours only and therefore did not take into account the conflict which occurred during the dusk and dark hours as the facilities for such observation were not available. Though it was concluded that little aggression occurred during dusk and darkness as the horse is not a nocturnal animal, and uses the camouflage of darkness to graze and rest. The stallions

studied by McDonnell *et. al.,* (1995) numbered fifteen, with the ages ranging from two to twenty-one years, and all were experienced at in-hand breeding. Although they usually grazed over nine acres of land, for the observation period they were limited to a two-acre paddock adjacent to the observation post. As the stallions were observed in a smaller space, it was suggested that the agonistic behaviour incidences would be greater than those occurring on the large pasture area, but that this did not affect the overall hierarchic challenge or change occurring naturally within the band. McDonnell *et. al.,* (1995) noted that in the herd of domestic stallions studied there was a distinct linear hierarchy. This hierarchy remained stable, as subordinate to dominant challenges were minimal.

Hoffman (1985) studied bachelor bands extensively, determining that males moved from the bachelor group when either they established their own harem by stealing young mares from established harems and making them their own, or by fighting to displace a harem stallion, thus gaining a harem for themselves. These incidences generally occurred when the stallions were between four and six years of age.

Hoffman (1985) also noted that the time spent by males within a bachelor group was vital for their future development as a harem leader. They developed social behaviour, fighting and aggressive skills, and they learnt about the acts of self-preservation, defence and attack. From the age of three to six there was an increase in agonistic and play behaviour within the bachelor group, a greater increase than that seen in harem groups. This was explained as being vital to their development as harem stallions in the future.

Further work by McDonnell *et. al.,* (1995) indicated that within a bachelor group there was a dominant stallion. Houpt and Keiper, (1982) confirm that within three feral herds of ponies on Assateague Island, Maryland, USA, the dominant stallion was the most likely to gain mares for his own harem band in the future. It was also noted that on rare occasions stallions never hold a harem band, and are never seen to challenge a harem stallion or attempt to abduct mares. It was therefore concluded that stallions without the urge to reproduce exist, with the suggestion that homosexuality exists within the equine world (Berger, 1977).

An artificial scenario was created at Minnesota Zoological Gardens to reflect a bachelor band, and assess the viability of establishing and sustaining a bachelor band of Przewalski horses (Equus Przewalski) to accommodate a surplus of males,

which had become a problem with the previous management system (Tilson, *et. al.,* 1988). Tilson *et. al.,* (1988) described the introductions of the various Przewalski horses along three lines of approach:

1 Colt groups established following their removal from the natal band, either the same natal band, or other bands;
2 Single colts introduced to adults in a spacious area;
3 More than one animal introduced to the established band at one time, thus reducing the aggression put onto each animal at the time of introduction.

Tilson *et. al.,* (1988) suggested that option 1 would produce a colt band that was not bonded in any way prior to establishment, and that the immaturity within the group would produce a low incidence of agonistic behaviour, thus a low injury risk. Option 2 had a greater risk of injury than option 1, due to the adults exhibiting aggressive behaviour towards the colts. Option 3 was the line of approach that produced the most natural groupings. The horses produced natural sub-groups, and a range of social matrices occurred, and thus this method was preferred. This does relate to feral horses at pasture, but a similar approach could be considered concerning the group housing situation.

Once the stallions reached the age of three to five years their adult interaction patterns developed, from which time they became incompatible in a bachelor group context. At this point their need to hold a harem increased, they began to resent the presence of other males and intolerance led to aggression (Tilson *et. al.,* 1988).

Bachelors, when leaving the bachelor group are reported to be sexually mature, and able to cover each mare within the newly established harem group themselves. Mares were usually covered successfully within their second or third year, though yearling mares have been successfully covered, to foal at two years of age, but males mature later, hence their leaving the bachelor band at up to five or six years of age (Berger, 1977; Hoffman, 1985).

2.2.3. The Territorial System

Some equid species, the Grevy's zebra, the African Ass (*Equus africanus*) and the Asiatic Ass (*Equus hemionus*) conduct what is known as a territorial system, in

contrast to the common harem system social structure of the horse, Mountain and Plains zebra (Klingel, 1972; 1975).

Within the territorial system each stallion dominates a section of land, rather than a harem of horses. If a foreign stallion approaches, the territorial stallion defends his land through conflict until the approaching stallion is defeated, if the territorial stallion is defeated and thus lost his land, his own retreat is generally rapid. If a mare in oestrus approaches and enters the designated territory, she becomes the sole property of that territorial stallion to mate with as and when required (Klingel, 1972; 1975).

Rubenstein (1981) carried out a study into the behaviour of horses on Shackleford Banks Island, off the eastern coast of North Carolina, USA. These horses all descended from the survivors of a shipwreck in 1565, and as the island measures only 19Km by 1Km it can be assumed that they are extensively interbred. Rubenstein's study identifies the herds of horses on the island have both defined harem structures and territorial structures. It was assumed that the narrow shape of the island influenced the behaviour to form both structures, as each group was separated by wide dunes and maritime forest, which divide the island into sections that are only passable at low tide.

It was stated that the territorial aggression increased when the food supply was limited, at high tide, and that aggression reduced as the marine forest became accessible at low tide. It was therefore concluded that the grazing area had an influence over the aggression that occurred, especially when essential resources were reduced. Conflict increased as the harem stallions tried to hold boundaries of land for their own harem's use, and the territorial stallions defended their land against outside visitors to maintain their own resources (Rubenstein, 1981).

It was noted that due to the poor vegetation available the ponies' body condition was poor, but that the herds rotated their grazing area every ten to fourteen days, to allow vegetative regeneration (Rubenstein, 1981). Berger (1977) noted movement patterns across the available land, migration from used grazing areas, to fresh areas. No other study has recorded such a structured grazing rotation as on Shackleford Banks Island. It was suggested that due to the situation, the horses had developed this rotation over a long period of time to maximise the limited natural resources.

Rubenstein (1981) asserted that the reproductive success within a territorial structure was higher than that of a harem based herd. It was concluded that the territorial stallions took and held oestrus mares, covering and keeping them, allowing older and infertile mares to move on with their harem band. It was concluded that harem stallions held mares with poor reproductive ability and territorial stallions did not, hence the higher reproductive success of the territorial stallion above that of the harem stallion. There was no mention of the presence of bachelor bands during this study.

Rubenstein (1981) is the primary source of information concerning the feral horse maintaining a territorial system, largely because of the rarity of the situation. It was stated in this paper that the high level of aggression noted within the territorial system was due to the decrease of grazing space during high tides, thus competition for food and other resources increased.

Evaluating this literature it is the researchers conclusion that this territorial structure would have a greater efficiency for resource utilisation and reproductive potential than the stallion trying to maintain a harem with limited space and resources. The aggressive behaviour noted was purely an incidence of stallions expressing dominance over one another to establish who had priority over land, and therefore the food upon it.

2.2.4. The Solitary Male

Berger (1977) noted that solitary males existed in the wild. Some were males which had never held a harem and others had lost a harem to another stallion. A minority of the males joined up with bachelor groups for a time, but often the older stallion did not readily accept the bachelor group situation, therefore generally remained in a solitary state until the end of their lives.

Relevant authors sited above have provided a variety of data concerning harem group structure in the wild horse, including those based at University sites, and also those at zoological sites. Though various studies have been completed, focussing on a variety of aspects of social structure of the horse, none of these authors have specifically related the data to the management of the modern Equidae.

From the literature reviewed above it can be concluded that detailed research has been undertaken concerning the various equine social and herd structures which

occur naturally. This information is of importance to the horse owner and manager with regard to the daily management of the horse (be it within a stables or a more natural field/pasture environment). With regard to specific stable and stable yard design, the differing herd structures which occur naturally and the reasoning's for these structures should be appreciated when a yard is designed so that good quality decisions can be made relating to the horses natural herd structure and thus the husbandry and management it requires. This should theoretically be reflected in the designs of stables, though it is the researchers opinion that this will only be reflected in a small number of specialist cases; such as studs. An understanding of the social structure of the horse is necessary to the stable designer to enable the design to reflect the social needs of the horse, which also requires an understanding of social interaction and time budgets of the horse.

2.3. Social Interaction and Time Budgets of the Horse

Before a review of the relevance of stable and yard design can be undertaken, it is necessary to describe social interaction in the feral horse, and in the domestic horse. Social interaction and time budgets are considered individually below.

2.3.1. Social Interaction

Research undertaken at the University of Aarhus, Denmark in 2007 concluded that the horse "preferred" physical contact with other members of their species. The study was conducted in stages, the first demonstrating that the horse chose physical contact with another horse, via bars between stalls, or by sharing a stable above being alone in its own individual stall. The second study stage investigated which type of interaction the horse preferred, using a push nose-button to determine preference and level of motivation (Specialequinesearch, 2007). Denmark has the highest number of horses per capita in Europe, and thus the University of Aarhus is working with the Danish Ministry of Justice regarding policy advice and new regulations for horse owners. An example of the regulations being that horse keepers must have at least two horses, therefore defining the need for horses to have the opportunity for social interaction, though the bill does not define the type or the minimal requirement of the social interaction (Specialequinesearch, 2007). Jansson, *et. al.*, (2008) write concerning paddock provision and management, rather than stable provision, recommending that horses receive no less than 3 to 4 hours in

a paddock daily, 1 hour being an absolute minimum which still leaves 20 – 21 hours per day in the stable.

Horse talk (2007) describes sniffing, nuzzling and rubbing as required physical contact behaviours. The University of Aarhus investigated how long it takes horses not previously acquainted to become "buddies". The study was undertaken due to the concerns of many horse owners when putting strange horses together for the first time, and the manner in which this is undertaken affecting the end result. The study concluded that initially an established horse group keep new horses on the periphery, and may subject it to "unfriendly" behaviour such as kicks, bites and/or shoves. This relates specifically to paddock managed rather than stabled horses, but must be considered should group housing be utilised and also regarding individual stables as neighbouring horses will be affected by a new occupant which may result in "unfriendly" behaviour causing injury to the occupants and damage to the stables.

Borsheim, *et. al.*, (2008) concluded that during the previous decade the number of leisure and hobby horses has increased dramatically, and though traditionally horses have been kept in individual stables and paddocks, interest in group housing has increased, but that limited research has been undertaken to determine social interaction and spacing within such housing systems. Borsheim *et. al.,* (2008) studied social interaction and spacing within gender groups and mixed groups. The results of the study were somewhat general with limited specificity, but concluded that gelding groups have a greater incidence of play, play fighting, social grooming and head resting than mare groups, but that aggressive interaction is lower in geldings groups than mare groups, and also mixed groups. This is a potential consideration for the examination of stabling provision in the UK where group housing is rarely utilised.

2.3.2. Time Budgets

2.3.2.1. Feral Horses

Boyd *et. al.,* (1988) studied the time budgets of Przewalski horses at pasture during the summer. Results were briefly described as: 46% of time feeding; 20% standing; 15% stand-resting; 7% in locomotive activity and 5% lying down. Other activities included: nursing; drinking; self-grooming; mutual grooming and playing, and amounted to the remaining 7%. The horse's studied (n = 8) averaged an observed

45 separate behaviour states per hour, with an increase in standing, and a decrease of grazing with an increase in air temperature, but these results were not quantified.

Boyd (1998) conducted a time budget study of harem stallions prior to and post reintroduction to a harem demonstrating the stallion spent: 47% of time grazing; 6% standing; and 5% in recumbent rest whilst separated and reintroduced to the group, but upon reintroduction there was a fourfold increase in movement time and a 50% decrease in time spent resting reflecting the active role within the harem group.

2.3.2.2. Domestic Horses

Carson and Wood-Gush (1983) undertook a literary review concerning feeding, eliminative and resting behaviour of horses, resulting in the conclusions that grazing behaviour of the domestic horse is not like that of the free ranging horse. Grazing behaviour is stated as being more complex than the feeding behaviour of the stabled horse, but no further detail is provided, except that the domestic horse sleeps for approximately 12% of the day, but it is not stated if the “day” refers to daylight hours, a 12 hour period or a 24 hour period.

Houpt *et. al.,* (1986) investigated the night time time budgets of domestic peri-parturient ponies whilst stabled and stalled. The stalled mares exhibited a 50% increase in eating time and a 100% increase in lying in sternal recumbency reflecting the limited movement opportunity which was available to them. Flannigan and Stookey (2002) studied the time budgets of draft mares and light mares kept in stalls. Recorded actions included: eating; drinking; resting; standing active; and all interactions (both aggressive and non aggressive) between horses. Stereotypical behaviours such as: cribbing; head bobbing; weaving; and wood chewing were also recorded. The time budgets of these two groups of intensively managed horses were within the ranges recorded for feral horses in other studies, though the light mares did spend a statistically significant greater amount of time feeding and less time standing active or standing resting than the draft mares.

Sweeting *et. al.,* (1985) observed paired stabled pony mares in adjacent stalls. The mares spent: 70% of time eating; 17% standing; 5.2% pushing hay; 2.9% walking; 1.9% drinking and 1% self grooming. Minimal time was spent: defecating; chewing non-food items; urinating; pawing and lying. For a period during the study visual contact between the ponies was prevented by a solid partition between the stalls. The stall partition affected the behaviour recorded in a number of ways: more time

was spent standing non-alert when the partition was in place; when hay was provided in the afternoon, feeding time increased when the partition was not in place; but overall less time was spent eating when visual contact was deprived, thus the conclusion was reached that social facilitation is an important factor regarding maintaining feeding behaviour.

When time budgets were studied within a high-density herd of Arab breeding mares (200 mares/ha); on a bare paddock in Tunisia, additional behaviours were observed, including: rolling; grooming; and lying down. In contrast, locomotion was the highest recorded activity, and the only social interactions recorded were agonistic interactions, though aggressive behaviour was not frequently demonstrated. It was concluded that the high-density situation reduced the horses ability to exhibit certain behaviours, and increased levels of other behaviours, producing an unnatural situation where natural behaviours are not exhibited at the expected levels (Benhajali, *et. al.,* 2008).

Weeks, *et. al.,* (2000) investigated aggression and social spacing of light mares at pasture. They concluded that higher ranking mares had priority for resources such as food and water, but experienced greater stress hormone levels, a shorter life span and reduced reproductive effectiveness. Results demonstrated that a higher ranking horse did have an advantage over supplementary feed availability and also displaced lower ranking horses from food and water, and resting places.

Kiley-Worthington (1997) is unique as it compares time budgets of wild grazing Camargue horses with domestic stabled horses. Table 2.1. illustrates the findings of Kiley-Worthington (1997).

Table 2.1. Time budgets of wild grazing Camargue horses compared to domestic stabled horses

Activity	Wild Grazing Camargue Horses (%)	Domestic Stables Horses (%)
Eating	60	15
Standing	20	65
Lying	10	15
Other Activities	10	5

The synthesised literature indicates that there have been a variety of studies undertaken into the social interaction of the horse in a variety of situations, including group management which differs greatly from the management system commonly seem in the UK where horses are grazed in small groups (frequently single sex groups) and stabled individually. Time budget studies tend to concentrate on the feral horse and not the domestic equine, though limited studies have been undertaken by Flannigan and Stookey, (2002) and Sweeting *et. al.,* (1985) concerning horses managed in stables and in stalls. These studies are also not particular up to date, and therefore may not reflect the current situation concerning stabling utilised today, or in the UK.

The information concerning social interaction and time budgets is of importance for the stable designer, but it would be helpful if study results were available concerning the social interaction and time budgets of horses within a conventional management system, so that the natural and the managed results could be directly compared. This would also allow for sound conclusions to be made concerning the influence of stabling on horse behaviour by taking into account the natural state, and therefore decisions could be made concerning the quality of the stabling provision which is commonly provided. This is returned to in the analysis section, Chapter Six. These factors require important consideration, as do the factors concerning the reasons for stabling horses at all and the arguments against stabling.

2.4. Stabling

As an integral part of this study, it is essential to consider the reasons why horses are stabled, and the reasoning's for and against stabling, though literature regarding these matters is limited.

2.4.1. Reasons for Stabling

Houghton-Brown and Powell Smith (1989) state that it is often the owners who desire the horse to be stabled for reasons of protection and convenience. A fit horse will have a reduced layer of protective fat, a reduced level of natural waterproofing oils in the coat due to grooming and is frequently clipped/part clipped, therefore lacking the protection of the natural coat at all (Houghton-Brown and Powell Smith, 1989). For the owner, the stabled horse is convenient because it is to hand, clean and dry, easy to feed and water, it saves grass, is secure and safe, can be easily monitored and

restrained and there is an increased ease of management if it is ill (Houghton-Brown and Powell Smith, 1989).

2.4.2. Stabling Verses Non Stabling

Strickland (1865) airs his strong views regarding stabling in his publication entitled "The cattle plague with remarks upon the drainage of farm buildings and stables". He quotes that when distemper broke out in the yard of the late Sir Tatton Sykes, eight of the best yearlings were selected, shut up in stables and nursed intensively. All these died, whereas the other eight which were left outside survived and recovered. It is stated (Strickland, 1865) that in the Crimean war, military horses stood outside at night in the snow, and that not one of them suffered any ill effects from the cold. Mr. Hall, the Master of the Holderness Hunt kept his stables at a lower temperature than previously expected and had a reduced level of horses which were classed as roarers and lower numbers of horses suffering from distemper and colds (Strickland, 1865). Strickland (1865) continues, that vices such as: crib biting; wind sucking; broken wind; weaving; and the incidence of navicular disease; are all due to bad men [owners] with reduced exercise for the horse, and there being no other cause.

McBane (1992) describes the use of stables "as a major mistake to put horses in individual cells called stables because the space is too restricted to be natural, there is changing air quality, reduced physical contact and reduced life quality". McBane (1992) further suggests that horses are segregated within stables for human convenience, so that the horse is easily accessible and clean when required, the workload regarding management is minimal and the horse's diet can be easily controlled. Caligula stabled his favourite horse (who was also a Member of the Roman Senate) in a marble stable with gold fittings, but modern horses are "kept prisoner" in stables, as hostages to the whims of those caring for them. Most stables do not provide enough space, ventilation or company, thus being inappropriate and stressful for the occupants, but these statements are not quantified by McBane (1992).

Kiley-Worthington (1997) agrees with the above, that stabling is largely for human convenience, and does not meet the horse's physical requirements in terms of: ventilation; feeding; and exercise; especially as the wild horse would travel approximately twenty miles a day, which would be impossible for the stabled horse to undertake. There is very limited literature concerning the reasons why horses are

stabled, and what is written appears to be related to the “not stabling” argument rather than being pro stabling.

Strickland writes as early as 1865 reflecting an appreciation of the importance of hygiene with regard to the stable environment, and that cold is not a negative management factor, but that reduced exercise due to stabling causes a multitude of health and behavioural problems. More currently McBane (1992) writes concerning both the reliance on stabling for human convenience, rather than for the benefit of the horse and states strongly that this management route has health and psychological implications resulting ultimately in the strong statement that quality of life is reduced. Kiley-Worthington (1997) is unique in stating considerations for improvement, including: group housing; an improved physical habitat; and the ability to perform natural behaviour.

The factors described above relate directly to the study in terms of stabling being fit for purpose for the modern Equidae in terms of the stable environment, which are returned to in the analysis Chapter Six, and also the holistic modern management which is beyond the remit of this study. The reasons for utilising stables require a clear understanding of the health of the horse and how aspects of stable design may impact negatively on health.

2.5. The Health of the Horse

The health of the horse in relation to stable design and construction appears to be a largely overlooked subject area, whilst it is of paramount importance, especially whilst taking into account the lengthy periods of time that some horses spend confined within their stables and the yard environment.

2.5.1. Environmental Condition

It is stated by a number of authors that pasture is preferable to stable or stall confinement with regard to the respiratory system of the horse. Buechner-Maxwell, *et. al.,* (1996) state that the respiratory system is usually affected due to poor ventilation, with straw bedding and hay being fed, resulting in respirable debris. Experimentation was undertaken by Buecher-Maxwell, *et. al.,* (1996) where horses were kept at pasture, in a barn and again at pasture. Tracheal mucosal secretions and tracheobronchial tissues were examined to determine changes due to changes of the management regime. The results showed no significant changes following the

horses being housed, but it was concluded that rather than the environment having no effect on the respiratory tract, the study period was too short to demonstrate significant change.

Clarke (1987) describes respiratory pathogens as including infectious agents such as viruses and bacteria, allergens such as fungal spores, irritants such as noxious gases, parasites such as lung worm, toxins such as 3 – methylindole and inert agents which "clog" the respiratory defence mechanism. Clarke (1987) states that the horse has a variety of clearance mechanisms to remove such pathogens/debris, the levels of retained pathogens as equated in Figure 2.1.

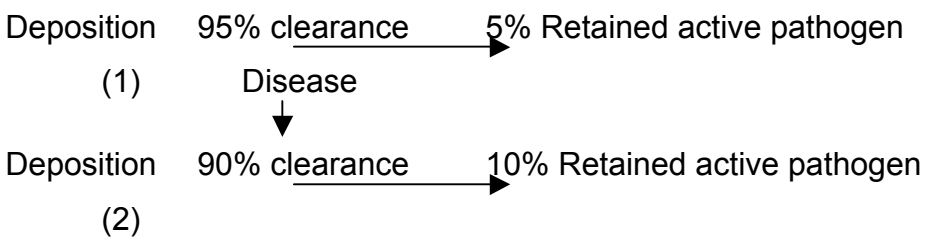


Figure 2.1. Respiratory Deposits and Clearance. (Clarke, 1987)

Figure 2.1. illustrates that a small decrease, as little as 5% in clearance leads to a large increase (doubling) in the retained active pathogens within the respiratory system.

More significantly Clarke (1987) states that the holistic stable environment needs to be taken into consideration, thus a horse lying with its nose next to a straw bed will be little effected by the ventilation rate within the stable itself. The suitability of the environment as a whole: ambient temperature; relative humidity; levels of noxious gases; dust; and airborne micro-organisms; all need to be taken into consideration. In the last century air samples demonstrated (Clarke, 1987) high mould levels from the hay which was fed. Today feed and bedding appear to be the source of high levels of dust, therefore today overt respiratory disease is associated with feed and bedding materials. Lungworm (Dictyocaulus arnfieldi) infestation is also stated as a possible antigen capable of causing hypersensitivity (Clarke, 1987).

In the same year Webster *et. al*. (1987) produced a paper concerning stable air hygiene, specifically stable design, ventilation and management regarding the concentration of respirable dust. Fungal spores are stated as being the main constituents of respirable dust in stables, the concentration determined by the rate of

release from fodder and bedding, and the rate of clearance by ventilation. Natural ventilation rates are stated as low, a minimum of four air changes per hour being satisfactory, but that though this level is commonly reached in individual stables, it is rarely met in large barns, and is impossible to reach in barns of twenty or more horses. Controversially it is stated that the bedding material makes no difference to the air quality (Webster *et. al.,* 1987).

Webster *et. al.,* (1987) studied ten barns containing between twelve and sixty plus horses in each. It was concluded that when the end doors were open the minimum four air changes per hour occurred, but when the end doors were shut only two air changes an hour occurred, therefore ventilation was below an acceptable level producing "dangerous" concentrations of respirable dust including fungal spores. This level of respirable dust increases three to six fold during bedding down times, with levels higher when straw was used rather than paper or shavings. Respirable dust levels appeared worst when uneaten or spilt hay was not removed from the stable. This study thus highlights the need to keep external doors open as much as possible, which is relevant to the Fitness for Purpose evaluation in Chapter Three, and to bed down the stables when the horses are not in them and to remove all uneaten and spilt hay which is holistic horse management and excluded from the study.

Crichlow *et. al,.* (1980) conducted a study into the dust levels at a Canadian stable over a four month winter period. Sixty seven horses were accommodated in thirty nine stalls and twenty eight loose stables adjoined the riding arena. The barn had a total of five doorways, four of these were always fully closed, except a small pedestrian access doorway within the larger doorway. The stable had two ventilation fans which produced a full air change every forty minutes failing to meet Webster *et. al.,* (1987) natural ventilation criteria as stated above. Air samples were taken at horse nostril height and studied between December and the following March, with a further study period in June when the stables were completely empty and all the doorways were open. The results demonstrated a mean concentration of airborne particles of 0.41mg/m^3 during the winter study period, and a mean concentration of airborne particles of 0.04mg/m^3 during the summer study when the yard was completely empty, equating to a variation of 90%. 30 – 40% of the particles obtained from the filters were capable of respiratory entry, thus of causing respiratory deficiency. Dust concentrations were greatest between 5 am and 11 am, which

corresponded with management tasks such as mucking out, and not necessarily the time of the greatest horse and rider traffic through the building. It was concluded that adequate ventilation was especially important during mucking out times, and that mechanical ventilation levels could be reduced when the ambient temperature is at such a level that the doors to the building could remain open (Crichlow *et. al*., 1980).

Respiratory health issues of stabled horses is examined further in Appendix 5.

Pilliner and Davies (1996) describe ventilation and fresh air as vitally important. Draught free air vents in the roof apex large enough to carry away stale air are required. Air inlets, such as the ½ or stable door with windows in an adjacent wall allows outside air to enter the stable. A clean stable, which is as dust free as possible, and the provision of storage for hay and bedding away from the stables, not adjacent to it is provided.

Sainsbury (1981) writes at length concerning ventilation and the environment with regard to respiratory health. Adequate ventilation utilising the stack effect, aspiration and perflation are described, along with the need for buildings to be well insulated with copious air spaces and where possible isolation from one horse to another, and that flow fans can be utilised where necessary to achieve the required air flow. It is stated that the ever increasing incidences of respiratory disease and infection in domestic animals is due to increased numbers being kept in confined and enclosed environments with incorrect temperature, relative humidity, ventilation rate and air flow.

Details concerning ambient temperature, and relative humidity are described, including that the burden on the respiratory system is increased by damp air; when humidity is at saturation and thus condensation produced. This is worsened when temperature is low and humidity is high, thus producing an ideal environment for the viability and also the inhalation of pathogens, and due to the high number of stables without insulation this is a common occurrence and problem Sainsbury (1981).

Sainsbury (1981) states that acceptable ventilation rates can only be achieved by the use of mechanical means as otherwise the required rates of 0.15 – 0.50m^3/second can't be achieved. It is further stated that it is assumed (Sainsbury, 1981) that ventilation is not important, but even the most sophisticated buildings exhibit below the required ventilation levels, and even though this is vital for the physiological well being of the horse few objective based investigations have been undertaken, and the

limited data has simply proven that it is easier to provide adequate ventilation in single stables or in small buildings, and virtually impossible in large buildings with a large number of horses.

Sainsbury (1981) suggests providing adequate ventilation; that large buildings should have an open ridge of 1-2 feet wide (with a protective flap) or corrugated sheets with unfilled gaps to provide a “breathing roof”. Alternatively Yorkshire boarding of 6 inch boards and ¾ inch gaps or hit and miss boarding where one set of boards slide over the other are suggested to be utilised especially on exposed sites. With regard to roofing, a mono-pitched open fronted shed where the front of the roof is higher than the back will provide free flowing air throughout the building (Sainsbury, 1981).

Sainsbury and Rossdale (1987) conclude that the approach to management of the horse is anthropomorphic, thus it is accepted practice to provide the horse with a hot bran mash after a hard days hunting; the human equivalent to providing a hot fireplace. The commonly maintained hot stable does provide a glossy coat, but also a thin winter coat which is not desirable (Sainsbury and Rossdale, 1987). This rather disjointed article continues that modern stables are architecturally inferior to historic buildings, that even with a clean bed, ventilation is vital and insulation is required which is not provided in the “flimsy constructions seen in new stables”. However there is no evidence within the article to support these observations. Barns are stated as being deficient in terms of ventilation due to common air space resulting in respiratory problems, and that this can be overcome by good insulation, well designed stale air outlets, fresh air inlets and an easy means of regulating airflow.

It can be concluded from the literature above that there are many environmental factors to consider regarding stables being fit for purpose, both in terms of the building fabric and design, which is the focus of this thesis and is returned to in the analysis chapter, Chapter Six, and also the holistic management system utilised within the stable which is excluded.

2.5.2. Behaviour - Abnormal and Stable Vices

Cooper and Mason (1998) identified that stable vices in the horse, as opposed to pure health issues as described above are undesirable for both economic and cultural reasons, and not because the quality of life is affected. Two solutions to undesirable behaviours (vices) are described. The removal of the casual factor and the use of pharmacological and/or physical prevention, which it is stated is justified if

the behaviour causes harm to the horse or to people or others. It is stated (Cooper and Mason, 1998) that the behaviour can cause considerable controversy in relation to animal husbandry practices because the behaviour may be inconsistent, offensive, unsightly, incomprehensible or may be perceived as an indication of suffering. This matter must be addressed, within this thesis especially where the behaviour demonstrated causes harm or is associated with an inadequate stable environment.

Cooper and Mason (1998) are one of the few authors to describe the differing concept of abnormal behaviour as perceived by ethologists and by veterinary clinicians. Ethology relates abnormal behaviour as being "away from the norm" as in statistically rare from a given normal population. Veterinary medical and psychology clinicians use abnormal behaviour as a diagnostic tool to identify pathological illness or damage. Ethologists describe behaviour patterns from the animal's perspective, how it affects quality of life, and how abnormal responses can be harmful, maladaptive or related to a poor environment, but may not actually be a problem for the horse. However abnormal behaviour does relate to welfare in four ways: as an indicator of poor welfare; means of adapting to a captive environment; the actual performance of the behaviour may be harmful; and that the behaviour can have little or no effect on the performers actual quality of life (Cooper and Mason, 1998). Abnormal behaviour can only be used as an indicator of potential non-well-being, but domestication must be taken into consideration, as the feral horse is a free ranging, social grazing herbivore, whilst a captive/domesticated horse is commonly stabled, provided with food and water of which there is no choice, reduced social interaction and reduced movement.

Differences in management or particularly in respect to this thesis a change of environment may not reduce or prevent abnormal and undesirable behaviours as the change of environment may not have changed the actual motivational element of the behaviour, the behaviour being totally independent from the cause. Abnormal behaviour is described by Cooper *et. al.* (2000) as stereotypic (atypical) patterns, (including weaving) which are commonly performed by stabled horses. A study recorded behaviours periodically between 09.00 and 16.00 in a variety of stabling conditions and environments with results concluding that stable design influenced behaviour and that weaving incidences were reduced in stables that were open to the front and one side, allowing the horse to view adjoining stables, and that greater weaving incidences were recorded in conventional stables with a ½ door at the front.

The contribution of animal psychology to animal welfare is considered by Watanabe (2007), stating that the concept of animal welfare is not permanently fixed, but socially mobile. Animal welfare is a multi disciplinary issue involving both anthropomorphism and behaviourism, thus the concept of continuity across human/animal minds and the matter of humans applying human psychological theory to animals, this being the foundation of animal related ethics.

The problem further applies to where and when animal ethics and welfare becomes an extension of human ethics and welfare. This is due to differing views that encompass diverse viewpoints which range from animals having no ethical rights, to every animal species having identical rights. Watanabe (2007) suggests that a sliding scale of care based upon the psychological, intellectual, consciousness and self awareness levels of the species in question, forms a framework where ethical rights increase along with the psychological ability of the species. The veterinary viewpoint appears to be that anthropomorphism is a positive starting point for the prediction of animal emotion and thus judgement concerning satisfaction and allied exhibitions of perceived emotions. It is stressed that animal welfare is necessary for the veterinarian, (Watanabe, 2007) the professional animal keeper and the companion animal owner. This raises both physiological and physical welfare considerations and questions, including the measurement of sensory ability, higher cognitive ability and pleasure, the parallels and similarities within human ethical practices and a thorough understanding of the layman's understanding and perception of welfare (Watanabe, 2007).

The influence of a neighbour's behaviour on a stabled occupant has always been in question. Nagy *et. al.* (2008) studied the correlation of exposure to a neighbour exhibiting stereotypical behaviour. It was concluded that: social isolation; housing; management conditions; and feeding regimes; all have a strong effect on the development of stereotypical behaviour, and that actual exposure to an abnormal stereotypical behaviour (ASB) does not significantly increase the risk.

The study concluded that the incidence of locomotive ASB's correlated with reduced exercise and social isolation, and where a horse had more than two riders weaving increased, but box walking decreased, demonstrating the horse experienced increased stress concerning two riders, but also greater exercise which reduced the incidence of box walking (Nagy *et. al.,* 2008). ASB horses exhibited reduced eating and resting time, and were generally stabled where there was considered to be a

disturbed environment in the yard. It was also considered that the previously common practice of isolating ASB horses was bad management as social deprivation further increased stress levels (Nagy *et. al.,* 2008).

McGreevy *et. al*. (1995) undertook a study investigating stereotypical behaviour in racehorses via a postal survey. The study concluded that ASB's (including weaving, wind sucking and crib biting and box walking) were attributed to: reduced social contact; reduced roughage in the diet; erratic management practices and routine; inconsistent training routine and methods; and generally the horses loss of control over the environment. Reduced social contact being related to Fitness for Purpose, the other factors being holistic management matters (McGreevy *et. al.,* 1995).

2.5.3. Individual and Group Housing Strategies

Fremstad *et. al*. (2008) studied the common myth that horses managed in groups injure themselves and each other, and that horses kept at grass in groups can be difficult to catch. Twenty groups were studied across Norway, the horses assessed for injury pre and post study, four months later. Seventy eight percent did exhibit superficial injuries, but there were no serious injuries reported and the study concluded that group housing and management was actually more of a problem for the horse owners and managers than for the horses, though of the horses utilised in the study seventy seven percent of the owners described the management as unproblematic, and twenty three percent as fine.

Individual housing compared to group housing results in reduced social interaction, thus Winther Christensen *et. al.* (2002) studied the effects of individual versus group housing in two year old domestic stallions. The study concluded that the stallions were sensitive to social deprivation and the effects of social exclusion lasted for over six weeks once the stallions were released into a group paddock. Singly stabled stallions exhibited a great degree of aggressive behaviour whereas group stabled stallions demonstrated more subtle agnostic behaviour such as displacement and submission.

Rose – Meierhöfer *et. al.* (2010) investigated behaviour within stabled horses and those within open barn systems. It was concluded that stabled horses exhibited reduced movement, and greater levels of stress, colic and feeding deficits than the horses in the group barns, and that the horses within the barns exhibited increased movement as the space available increased, and also as the size of the group

increased. The use of automatic feeders increased movement, as did the use of bush vegetation within the open section of the barn, thus allowing the horses to move around the natural obstacles at will.

Harewood and McGowan (2005) compared the behaviour of horses in outdoor group paddocks and in individual stables, concluding that whilst stabled (at least ten meters apart from another horse) the horses exhibited stress related behaviour, thus the isolated, confined stable and high concentrate diet is not the optimal condition in which to keep horses.

Werhahn *et. al.* (2011) investigated the behaviour of competition horses in stables. In Germany valuable competition horses are constantly housed as paddock use may result in accidents and injuries, and also that a horse which has free exercise when turned out will be less willing to work whilst being trained, thus impinging negatively on its competition career. The results concluded that when turn out was not available the horses became increasingly restless, having a negative effect on training, which contradicts the general accepted viewpoint on this matter.

In contrast positive behaviour during training was observed when turn out occurred following the previous training session, in these cases the horses demonstrated less ground covered whilst turned out, less trotting and cantering and less agitated behaviour, and a greater time spent dozing. It was thus concluded that turn out was essential to the horses psychological well being, and though training exercise may partly replace the need for free turn out, it does not replace it fully, and when it is not available the horse becomes stressed, as well as exhibiting abnormal behaviour and increased incidences of musculoskeletal and respiratory disease (Werhahn *et. al.*, 2011).

As stated at the beginning of this chapter, the health of the horse in relation to the design and construction of stables appears to be a largely overlooked subject area, even though detailed information is available following research into the health of the horse. The literature synthesises the importance of quality ventilation, the use of poor bedding materials, pathogen levels within the stable environment and also changes within management practices over time.

Though not common within the UK, group housing verses individual housing systems have been studied across Europe where the practice is more commonly utilised. It is concluded that limited or nil examples of these systems will be seen during the case

study, as this system is not popular within the UK due to practical and management issues, though it may be concluded that this system should be investigated further in the future for welfare reasons. Horse health, both physical and psychological, depends on suitable management strategies, including the factors above. Management strategies are described in the following section.

2.6. Management of the Horse

The management of the horse has changed greatly over time, corresponding directly with the changes to the use and purpose of the horse, most notably its common change of use from a working animal to a pleasure animal. Management has also changed due to welfare expectations and socio-economic changes, including the demise of the landed estate and the increase in private horse ownership.

2.6.1. Horse numbers in the UK

Horse numbers have fluctuated greatly, as have the division of working and leisure horses. Powell (1991) states that the use of the coaching horse was in its heyday in the 1820's and 1830's when there were an estimated 150,000 coach horses nationally, with one of the largest stables being at Hounslow housing 2,500 horses used for the westbound service out of London. As the use of the horse drawn omnibus increased the use of the stage coach reduced and thus the horse numbers used by each sector fluctuated. The use of the donkey was also popular, with the Costermonger's donkey stables adjoining the Columbia Market in Bethnal Green housing over 50 donkeys in 1877.

Gray (2001) concludes that in 1890 there were an estimated 300,000 working horses in London, and that during World War I (1914 – 1918) in excess of 500,000 British riding and draught horses were killed on the Western Front. With the increased popularity and use of the railway, horses became commonly used for short distance haulage; from the railhead to the customer. It is estimated that by 1915 the Great Western Railway had in excess of 20,000 horses across their rail network (Powell, 1991). Horses used within agriculture were estimated at 1.3 million in England and Wales in 1903 (Gray, 2001) declining to 900,000 before World War I with each farm needing one horse per twenty to twenty five acres (Powell, 1991).

The British Horse Society (2012) states that the current number of horses in the UK does not exceed one million, being stated as 988,000.

2.6.2. Horse Management

Clark (1800) writes negatively concerning the general management of the horse at the time of writing. Stable temperature is stated as being too hot, the situation exacerbated by limited ventilation provision and therefore limited fresh air. It is described that first thing in the morning, when the stables have been shut up all night the air is foul due to the horse's urine, and that this attacks the horses eyes and nose, causing copious amounts of discharge and also foul air not expanding the lungs, reducing circulation of the blood, and thus causing disease to accumulate in the organs, making the horse susceptible to many ailments including colic and gripes which can be fatal. Cox (1871) adds that it is detrimental to health to keep a horse in an excessively warm environment, then remove clothing when exercising in the cold, and then returning it to a cold stable; stating further that damp and moisture collecting on the walls, the roof and the windows are extremely pernicious to health, and produce noxious conditions.

> *"Moist air relaxing the fibres and dry air constricting the fibres, both resulting in disease, and cold air being bracing, thus conducive to strength and activity".*
>
> Cox (1871)

It is not stated what fibres are being referred to, but is accepted to be referring to the respiratory tract.

Winter (1846) describes stable improvements that occurred following the establishment of the Royal Veterinary College (RVC) in 1791 as "marked". What is today the RVC was founded as the London Veterinary College in Camden Town, signalling the initial development of the veterinary profession in the UK, the first four students being admitted in 1792 (Royal Veterinary College, 2009).

It is stated by Winter (1846) that diseases due to improper housing reduced due to improvements but that hygiene standards were disregarded and construction of stabling was misunderstood and neglected. Damp floors were improved by the introduction of underground drainage, though the majority of cart stables within London still maintained a central grate and cesspool, which then had to be hand cleared using a bucket, producing unhealthy gas. It is stated that dung and soiled litter should be removed on a daily basis, but that excessive bedding allowed the horse to lie down resulting in "foul feeding", unfortunately a description of "foul

feeding" is not included. The use of hayracks was discouraged due to hay seeds falling into the horses eyes and caused blindness (Winter, 1846).

Cox (1871) evaluates management practices such as how to reduce the level of ammonia in the stable by using granulated or powdered peat-charcoal and that a good quality bed can be achieved by using two inches of sawdust with a straw bed on top, and that should a horse paw at its bed, it should be hobbled to prevent this habit. It is stated (Cox, 1871) that drainage, air, feeding and watering are all pertinent to the health of the horse, drains being in the form of a shallow gutter at the rear of the stable floor, which is sloping. Paving should be of brick, with all internal stalls being South or South westerly facing, facing the midmorning or midday sun and being between thirteen and fourteen feet by eight and a half to nine feet (3.96 and 4.26 meters by 2.59 to 2.74 meters), though stables are considered to be better than stalls (Cox, 1871).

The use of the common public livery stable is mentioned, concluding that the horse rests very little in this environment due to the high level of disturbance being unsettling, resulting in both reduced circulation in the legs, and the spread of infectious and contagious diseases (Cox, 1871). Cox (1871) is unique at this time for commenting that horses are sociable creatures, and that no stable should contain only one stall rendering the horse totally alone but also that each stable should not contain more than six to eight stalls, and that these should be large and roomy, with a clean straw litter bed, dung removed regularly, the horse not wearing excess clothing and the stable being aired frequently, with doors and windows being left open when the horse goes out during the day.

Harris (1999) states that recent management practices, including feeding vary greatly, and that there is limited data available, but that it can be concluded that the horse is fed and managed in a manner to reflect the purpose for which it is kept, and that there are distinct differences between: the thoroughbred and the native pony; rural and urban locations; the time of year; the breed; the age of the horse/pony; and also the financial situation of the owner. Management is further divided into professional riders, owners and trainers, including large yards which are managed by professionals and the amateur competitor and leisure rider with horses kept at livery, at home or at a friend's (Harris, 1999).

Commonly in the UK the Thoroughbred type horse is managed in a complex manner; stabled but commonly having access to grazing, though not always, and clipped and rugged during the winter months. The native pony tending to live out, with the hacking or general-purpose horses being managed as a combination of the above depending on circumstances (Harris, 1999). Urban horses tend to have reduced turnout facilities and horses kept at the owner's home tend to have a lower total number of horses than kept at professional yards.

Changes in feeding and bedding practices have occurred over time, with straw (wheat) remaining a common bedding material as it remains low cost, easy to obtain and dispose of and provides a warm and comfortable bedding. Oats, a traditional feed, is less commonly used, with an increased use of formulated products such as pellets, cubes and nuts with carrots and apples being a common additive. The feeding of hay has changed from: the traditional use of hayracks which could allow hay to fall into the horse's eyes, and potentially cause injury by trapping a leg: to the more recent use of a hay net, which could still cause the above problems; to feeding from the floor in a more natural feeding position (Harris, 1999).

Harris (1999) provides the sole limited modern authorship regarding the above information, being the seminal source of published nutritional management expertise. This work is relevant as it provides a number of management welfare conclusions: Urban horses spend a greater time stabled, and feeding hay from the floor reflecting the natural feeding position of the horse, all which reflect on the Fitness for Purpose of the stabling provision provided.

2.6.3. Watering Practices

Literature published over the last 150 years provides confusing and conflicting advice demonstrating mismanagement and ignorance concerning watering provision (Hinton, 1978), an obvious solution being to provide adequate drinking water at all times when the horse is at rest and sufficient drinking opportunity whilst working.

Hinton (1978) stated that between 5 ½ to 19 gallons is the daily water requirement for the horse, which is slightly more than stated by other authors, including the Pony Club (1988) who state that between 4 to 15 gallons are required daily. A number of methods for providing water include: buckets; a bowl in a manger; an automatic watering bowl. A large wooden pail being preferable in the stable, with a galvanised, plastic or rubber bucket being a good alternative. For field use; flowing water in a

pond or stream is suitable provided that a depth of at least four inches is available. A brook or pond is defined as a better water source than a well (Pony Club, 1988).

Hinton (1978) analysed the differences in opinion concerning the temperature at which the water is provided, as cold water may cause colic so the chill should be taken off before it is offered, but, it is stated that Russian cab horses were frequently provided with icy water and appeared to have had few problems. Therefore water temperature has been excluded from Fitness for Purpose evaluation.

Sufit *et. al.* (1985) studied the drinking habits of ponies under natural and artificial thirst conditions and concluded that when food and drink were readily available the ponies drank for twenty seven minutes a day, eighty nine percent of which was between ten minutes prior to and thirty minutes post feeding. When the ponies studied were deprived of water over night they corrected this by drinking the amount they would normally have drunk overnight at the first opportunity thus it was concluded that management practices should accommodate the horses drinking patterns by providing water ad libitum, or at least in association with meals. Welford *et. al.* (1999) studied the effects of changes to management scheduling on water intake by the Thoroughbred concluding that drinking increased around normal feeding times.

The provision of water for the stabled horses is relevant to this thesis as it reflects a clear welfare issue related to the elements of Fitness for Purpose; being the expected method of providing water, and also the source of the water which is provided.

2.6.4. Bedding Practices

Deep bedding is suitable provided quality drainage is provided. Suitable flooring being described as loose weave asphalt or brick laid on gravel, whilst concrete, a common flooring material is described as “a less suitable floor is hard to imagine” being hard, cold, absorbent and holding urine (McBane, 1992). Old fashioned flooring, for example stable bricks with a thin day-bed work well, but not with modern bedding practices. A slight slope will prevent urine pooling, and the old fashioned idea of a central internal drain, provided blockage is prevented, and a strong mesh cover being used to make it safe, work well (McBane, 1992).

Pedersen *et. al.* (2004) studied the influence of bedding on the time budgets of the horse with regard to time spent recumbent and concluded that those bedded on

straw had three times longer in lateral recumbency than those on shavings, though sternal recumbence did not demonstrate any change with regard to bedding material. It was also concluded that as lateral recumbency is necessary for paradoxical sleep, bedding on shavings may reduce welfare levels and also athletic performance. It is stated (Pedersen, *et. al.,* 2004) that bedding choice is largely traditional, with the human perception being to make the horse comfortable, whilst reducing workload and husbandry.

Bedding practices relate specifically to this thesis as it affects the hygiene and welfare status of the stable, reflecting directly on the health of the horse housed within the stable, and also that sleep may be affected due to bedding choice, thus reflecting a specific welfare aspect of Fitness for Purpose stable management. This relates specifically to the design of the stable, as bedding may require selection to be appropriate to flooring materials, gradient and drainage provision.

2.6.5. Feeding Practices

The stomach is rarely empty in the grazing horse, resulting in a protective layer of forage particles forming between the cardiac (upper) and the pyloric (lower) section of the stomach. The cardiac section of the stomach utilises the forage particles to protect it from the acidic gastric contents in the pyloric section of the stomach. In the stabled horse with a reduced forage diet, this protective layer appears to be impeded and therefore provides inadequate protection from the acidic stomach contents, and thus irritation and gastric ulcers may result. In addition, the additional chewing required for a forage diet increases saliva production, and thus gastric acid production is not as great as in the grain/corn fed diet.

It is suggested (McCall, 2004) that crib biting induces saliva production when forage is limited, thus buffering the stomach from the acidic gastric contents. In addition it is suggested (McCall, 2004) that: daily exercise; the feeding of small feeds at numerous times during the day; and providing more than 1 hay/fibre/forage source within the stable; will reflect natural foraging and grazing behaviour. It is also suggested (McCall, 2004) that stalled and stabled horses require visual contact with other horses to promote normal feeding behaviour, and that this can be enhanced by providing stable mirrors if visual contact is not possible. The best manner in which to manage the horse is by naturalising the nutrition, housing and care of the horse to mimic free-ranging conditions as much as possible (McCall, 2004).

This links to Fitness for Purpose (Table 6.4), taking into account the physical attributes of the stable, but also the social interaction and free exercise provision.

2.6.6. Stable Size

Most horses roll before rising within a stable to reduce the chance of getting stuck against the stable walls. This brings in to question the suitability of the suggested stable size stated in modern management literature. Pedersen *et. al., (*2004) recommend that each stable wall should be twice the length of the horse, thus the average recommended 3m x 3m stable being inadequate, and at least 3.2m x 3.5m or larger is required (Pedersen *et. al.,* 2004).

Raabymagle and Ladewig (2006) also studied the influence of stable size on lying behaviour. The results showed that recumbency time in a larger stable was 10 minutes more per day than for the small stable. The incidence of rolling prior to getting up was 3 times greater in the small stable than the large stable, but when horses were moved from the small stables to the large stables the incidence of rolling prior to raising did not decrease, indicating a degree of learnt or accustomised behaviour and that it may be harder for a horse to adjust to a small stable than to a large stable.

It is therefore recommended by Raabymagle and Ladewig (2006) that the stables shortest wall is at least 1.5 times the height of the horse at the withers, and that the footprint must be at least twice the height at the withers squared. In the UK a 13m^2 stable is recommended through practical knowledge rather than study (Horse and Rider, 2009 and Draper, 2002), whereas in Sweden a minimum 8m^2 is recommended for a small horse, and 9m^2 for a large horse. These figures are based on case study research (Raabymagle and Ladewig, 2006), and are significantly less than the UK recommended size. With regard to the results found by Raabymagle and Ladewig (2006), it must be questioned if there are welfare implications of such a small stable size being considered acceptable.

The recommendations of Pedersen *et. al.* (2004) and Raabymagle and Ladewig (2006) are contradictory. Table 2.2. illustrates the different recommendations of Pedersen *et. al.* (2004) and Raabymagle and Ladewig (2006) with regard to 14.2HH, 15.2HH, 16.2HH and 17.2HH horses. Horse length data has been taken from standard horse rug size chart data (Ride-Away, 2013), since Pederson *et. al.* (2004) does not state horse lengths. This relates specifically to this thesis in that there are

significantly conflicting conclusions published regarding the suitable size for a stable, and the reasoning's for the size selected are based on a variety of theories or simply based on tradition. It is apparent from the above literature that stable size will have a reflection on the stable being Fit for Purpose for the modern Equidae.

Table 2.2 Stable Size Recommendations: Pedersen *et. al.* (2004) and Raabymagle and Ladewig (2006)

		Minimum Recommended Size for Horses as Stated							
		14.2HH		**15.2HH**		**16.2HH**		**17.2HH**	
Pedersen *et. al.* (2004)	Each wall = 2 x length	11’	3.35m	12'	3.65m	13'	3.96m	14'6"	4.45m
Raabymagle *et. al*. (2006)	Shortest wall = 1.5 x height	7'3"	2.22m	7'9"	2.40m	8'3"	2.52m	8'9"	2.71m
Raabymagle *et. al*. (2006)	Footprint = 2 x height squared (inches)	93 sq feet	8.64m^2	107 sq feet	9.94m^2	121 sq feet	11.42m^2	136 sq feet	12.63m^2
Raabymagle *et. al*. (2006)	Footprint = 2 x height squared (stable size)	9'9" x 9'9"	3.01m x 3.01m	10'6" x 10'6"	3.23m x 3.23m	11' x 11'	3.35m x 3.35m	11'8" x 11'8"	3.59m x 3.59m

2.6.7. Equidae Behaviour

Zeeb and Schnitzer (1997) state that any kind of horse housing in accordance with the animals needs should anticipate the consideration of the evolutional characteristics of the horse. It is further stated that since the horse naturally moves and feeds for in excess of sixteen hours per day, without this opportunity tendons, ligaments and joints reduce in elasticity and there is an increased risk of injury. Reduced exercise also decreases the natural cleaning of the respiratory tract. This is accepted as directly impinging on Fitness for Purpose and is reviewed below.

Stalls are described as being termed “tethered stalls” and should be used with the exclusion of the young horse, and may not be tolerated by all/other horses. The use of stalls is described as unjustifiable within newly built stabling, with single stables with all round paddock access or the use of loose housing for groups of horses and a paddock being deemed more acceptable (Zeeb and Schnitzer, 1997).

The behaviour of the horse is affected by the stabling provision – where social needs are not met the horse may exhibit behavioural disorders due to limited horse to horse contact, and the horse may also seek increased horse to human contact as an alternative, though this does not fully meet its social needs either. Social needs do need to be taken account of within a stabling complex which does not include the use of stalls, with the stabled horse having the opportunity to be out of sight of a higher ranking horse by means of partitioning or walls (Zeeb and Schnitzer, 1997). Zeeb and Schnitzer (1997) describe the advantages of the young horse being maintained in a social group situation, but that separation at times may be required for health reasons, and to allow for all horses to feed in a relaxed manner, without disturbance and to allow individual dietary needs to be met which may be difficult within a group housing situation.

It is suggested (Zeeb and Schnitzer, 1997) that the use of tethered stalls are limited to horses performing in the circus, or utilised as a labour (working) horse, thus assuming that time within the stall will be limited as the horse will be working for an acceptable proportion of the day. The size of the stable (Table 2.3.) is a matter described as having no hard and fast rules, due to the varying size of the horse and pony, but that the stabling and management which is provided must provide: maximum security; mutual contact; varying experience; adequate space; stimulation

for exercise; light; fresh air; plus good grooming; and the services of an understanding farrier.

Table 2.3. Suggested measurements for stabling relate to the withers height of the horse (height to withers = Wa)

Stable size	Stable minimum size	$(2 \times Wa)^2$
	Narrow side of stable	1.5 x Wa (minimum)
Wall/Partitioning	Total partition height	1.3 x Wa
	Solid lower part, grill upper	0.8 x Wa
Doors	Total door height	1.35 x Wa
	Solid lower ½ door	0.7 – 0.8 x Wa
Passage width *		1.0 – 2.0m
Alley width *		2.0 – 2.4m

*(It is not specified what exactly passage and alley refer to)

Adapted from Zeeb and Schnitzer (1997)

Zeeb and Schnitzer (1997) conclude by stating that behavioural and physical problems relating to stabling are caused by: faults with management; inadequate daily exercise; inadequate stable size; inadequate turn out; and inadequate fresh air. As previously stated this thesis will only deal with Fitness for Purposes issues and holistic management issues will be excluded.

Sondergaard and Winther Christensen's (2006) study details that Danish horses are primarily sports and leisure animals, producing low economic incentives to keep horses in intensive management systems and that the majority of horse owners strive to provide the best management conditions for their horses. It is stated that though quality management is strived for, the basic needs of the horse are not always met by modern housing systems and related behavioural problems occur as a direct result of the housing and the management systems utilised.

Physical conditions such as space to perform normal maintenance behaviour such as lying down, getting up and basic body care are impeded by tethering in straight stalls, which were common up until the last century, when the provision of stables increased. Stables are preferable over straight stalls in which the horse is tethered, but still provide only limited freedom of movement and contact with the neighbour (assuming there is a neighbour). A variety of stable designs provide differing opportunities for the horse to perform social interaction. Open stables provide a greater degree of contact than stables with solid walls, stables with bars allow nasal contact, and closed stables with solid walls provide very limited/no physical or visual contact. It is stated that low levels of locomotion within the stable are due to reduced social behaviour following prolonged social deprivation, though it is stated that many (valuable) horses are managed separately to reduce the risk to themselves, whereas those managed extensively have a greater level of social interaction. The extensively managed horse follows a more natural regime than an intensively managed horse, with the extensively managed horse spending a great deal of time eating a high fibre diet, whereas the intensively managed horse spends much less time eating a high concentrate diet, and thus induced feed related oral stereotypes and increased wood eating occur (Sondergaard and Winther Christensen's, 2006).

Sondergaard and Winther Christensen's (2006) conducted a questionnaire concerning the stabling and management of horses in Denmark. The results were collated for a variety of establishments including studs, riding schools and private owners, and a variety of breeds and types including riding horses, heavy draught horses, small horses, large ponies, small ponies, Thoroughbreds, trotters and those of non-specified breeding. Of the questionnaires returned 65.1% of horses were kept in individual stables, 23.5% in group/loose housing and 10.9% in stalls. This enabled 53.6% of horses to have sniffing contact, 24.4% to have unlimited physical contact, 15% to touch/groom, and only 7% with no social contact, or only visual contact. It was stated that 8.3% of horses exhibited "abnormal behaviour" including: crib biting; box walking; weaving; tongue playing; grinding of teeth; wood chewing; pawing; and agitated behaviour at feeding time. 17.2% of those exhibiting abnormal behaviour were Thoroughbreds, but unfortunately it is not stated which management regime they are managed under, though it can be realistically concluded that they are most likely to be managed in stalls or individual stables, and very unlikely to be managed in group/loose housing (Sondergaard and Winther Christensen, 2006).

It is stated that riding and racing horses are predominantly stabled, whereas small horses and ponies are predominant kept in loose housing on an extensive system. 97% of the horses in the survey had access to pasture on a daily basis, thus enabling Sondergaard and Winther Christensen (2006) to conclude that the owners and managers understand the importance of access to pasture. Only 1% of the respondents horse were kept in straight stalls without daily pasture access, but from the details available it cannot be concluded why this is the case. The study does produce results indicating a lower level of abnormal behaviour than other historical studies. It is concluded that this is because of the relatively low level of responses – only 152 returns relating to 1,631 horses, and that the respondents may be those with a greater than average awareness of the needs of the horses in their care (Sondergaard and Winther Christensen, 2006).

Sondergaard and Ladewig (2004) studied the effects of group housing on the behaviour of the young horse during training. The horses studied were handled in a structured way for ten minutes three times a week from the age of six months to two years of age. Training activities included leading, tying up, and lifting feet and the training continued to the next stage once a stage had been successfully “passed” along comparable guidelines. Twenty Danish stallions were used in the study, with eight being housed singly and twelve housed in four groups of three throughout the study. Those housed singly were stabled in $9m^2$ stables, those in a group in a $27m^2$ stable, and all were turned out into a paddock for three hours a day either singly or in the established groups. The study concluded that it is beneficial to house young horses in groups rather than singly as group housed horses ”passed” more stages than the singly housed horses, and also bit the trainer less!

With regard to the time frame to establish a group successfully Sondergaard and Turner (2008) concluded that with two year old fillies it took between six and seven days for familiarity to develop as greeting behaviour reduced and the distance between the horses decreased. It was a limited study, with narrow parameters, but it must be remembered that horses are required to enter established groups, or to establish groups a number of times during their lives due to changes in ownership, training yards or livery yards. Similar conclusions were reached in the article www.agrisci.org/ny (2008a) where it is stated that horses thrive better in groups once established with a leader and a ranking order. The importance for horses to develop

social skills within an established group is of paramount importance as most horses have to move yards and stables a number of times during their lifetime.

It can be concluded that much has been written concerning modern management of the horse. Management is recorded with regard to financial influences and human convenience, and little reflection on the requirements of the occupants. Management is also stated as reflecting the knowledge and level of competence and professionalism of the owners and keepers concerned. Modern management is recorded in relation to the type of horse which is kept, and thus to a large extent reflecting how it is kept, the feed utilised, the bedding utilised and the size of the stable required. To this extent this is examined in more detail later in this chapter. Human – horse relationships and interaction is detailed with regard to the working horse, the leisure horse, and also regarding the use of the horse as a therapeutic tool.

Horse management and the development of management strategies is allied to the evolution of the stable and the stable yard. The development of the stable is presented in the next chapter. Chapter Two demonstrates knowledge gaps and scope of research within the literature available as follows; The Development of the Modern Horse: the literature demonstrates the historic development of the *Equus Caballus* species, but is limited as far as the development of modern breeds, and the use of the modern horse, such as the development of the leisure and sport horse.

Social Structures of the Horse: the literature demonstrates wide research into social structures of the feral horse in a number of locations and situations, but limited recent research into this field. In contrast, literature relating to social interaction and time budgets covers a wider time scale, including the more recent, and does include both feral and domestic horses, though is limited concerning the conventional stabling situation, and also research from within the UK, thus is limited concerning the commonly utilised management systems within the UK.

Stabling, specifically the reasons for stabling and stabling verses non stabling is relatively limited concerning available literature, and therefore limited in scope, and also academic content, appearing to be authors opinion, rather than scientifically based. A gap in literature and research concerning the actual health and welfare of the horse relating to stabling and non-stabling is apparent.

Regarding the Health of the Horse; literature concerning horse health appears to be very specific rather than holistic, focussing on a specific area, for instance respirable pathogens, though there appears to be increasing awareness of behaviour, both perceived normal behaviour, and abnormal behaviour/stable vices. The literature does generally lack in the relationship between management practices and behaviour, and how the management practices can be balanced to minimise negative behaviour factors.

Management of the Horse is a huge field, which is widened due to the variety of types of horse over time, and currently within the UK. One distinct gap is the definitive number of horses within the UK, due to the current situation where though all horses are supposed to be registered and have a passport, there is no central registration and passport system, with individual organisations managing their own systems. The literature describes a variety of historic and modern management practices, including stable size, but demonstrates gaps in up to date research into management practices, including the effects of stable size.

Table 2.7. Synthesis of Literature: The Horse

	Reference	Strength	Weakness
The development of the modern horse	Clutton-Brock (1992) Simpson (1961). Hartley Edwards *et. al.*, (2008)	Detailed historical data Relates historical development to present day; breeds and use of horse	Purely historical Limited comparable contemporary data
Social Structures of the horse	Berger (1977), Estes (1974), Feh (1988), Hoffman (1985), Houpt, *et. al.,* 1978), Houpt and *et. al.*, (1982), Kaseda and Khalil (1996), Kaseda and Khalil (1997), Klingel (1975), Klingel (1972), McDonnell and Haviland (1995), Miller (1981), Monard and Duncan (1996), Rubenstein (1981), Schoen, *et. al.,* (1976), Tilson *et. al.,* (1988).	Detailed data concerning hierarchy/structure over long period of time in a variety of situations and over a variety of time periods.	Data not related to modern management practices.
Social interaction and time budgets of the horse	Specialequinesearch (2007) Horsetalk (2007), Jansson, *et. al.*, (2008) Borsheim, *et. al.*, (2008) Boyd *et. al.,* (1988)	Management aspects for Danish horse owners Paddock provision, Social interaction Group housing provision Time budgets of wild horses	Not fully specific regarding legislation Not stable specific but relevant Not common in UK at present Not related to domestic horse

	Carson and Wood-Gush (1983)	Compared 'free ranging' horses to domestic horses	Literature review rather than practical study
	Houpt *et. al.,* (1986)	Domestic horses studied	Peri-parturient ponies studied specifically
	Benhajali, *et. al.,* (2008), Flannigan and Stookey (2002) Sweeting *et. al.,* (1985) Weeks, *et. al.,* (2000)	Time budgets of domestic horses studied	Not specifically related to wild horses/situation
	Kiley-Worthington (1997)	Time budgets of wild Camargue horses compared with time budgets of domestic stabled horses	Breed specific (Camargue horses) studied, therefore questioned if relative to generic horse population
Stabling	Houghton-Brown and Powell Smith (1989), Kiley-Worthington (1997), McBane (1992), Strickland (1865)	Related stabling use to management	Limited specified data to collaborate statements made
		Related negative aspects of stabling to management	Limited balance view/positive stance in stabling
The health of the horse	Buechner-Maxwell, *et. al.,* (1996)	Practical study undertaken	Conclusions not equitable from results obtained
	Clarke (1987), Sainsbury (1981), Webster *et. al*. (1987),	Holistic stable management practices integrated	Limited relationship to specific negative/positive management practices described
	Crichlow *et. al,.* (1980), Pilliner and Davies (1996),	Holistic stable management practices integrated	Specific negative/positive management practices described

	Sainsbury and Rossdale (1987)	Anthropomorphic management practices and modern stabling quality described	Limited scientific backing to statements/conclusions
	Cooper and Mason (1998), Cooper *et. al.* (2000), Nagy *et. al.* (2008), Watanabe (2007),	Abnormal behaviour/stable vices including ethology and relationship to welfare/ethics	Limited data in terms of negative aspects of abnormal behaviour/stables vices to stabling provision and management practices
	McGreevy *et. al*. (1995)	Study concerning stereotypical behaviour	Specific to racehorses, therefore restricted questioned if relative to generic horse population
	Fremstad *et. al*. (2008)	Group housing studied	Not common management practice in UK
	Winther Christensen *et. al.* (2002)	Study of individual verses group housing	Specific to two year old domestic stallions, therefore restricted questioned if relative to generic horse population
	Rose – Meierhöfer *et. al.* (2010)	Study concerning both stabled horses and those in open barns	Doesn't relate the situation to social interaction, though does mention health in limited terms
	Harewood and McGowan (2005)	Compares behaviour in outdoor group paddocks and individual stables	Health and welfare not specified, only behaviour

	Werhahn *et. al.* (2011)	Relates management to training	Restricted to German stabled competition horses
Management of the horse	Gray (2001), Powell (1991)	Historic horse data	Historic horse data
	British Horse Society (2012)	Current horse data	Most recent data 2012
	Clark (1800), Cox (1871), Royal Veterinary College (2009), Winter (1846)	Historic management practices	Historic management practices
	Harris (1999), Hinton (1978), McBane (1992), McCall (2994),	Contemporary management practices	Contemporary management practices
	Pedersen *et. al.* (2004), The Pony Club (1988),	Practical study: drinking habits	Normal and restricted watering practices studied
	Sufit *et. al.* (1985), Welford *et. al.* (1999)		
	Draper (2002), Horse and Rider (2009), ** Raabymagle and Ladewig (2006), ** Pedersen *et. al.* (2004),	Stable size (** practically studied)	Limited practical study to determine conclusions and recommendations
	Sondergaard and Ladewig (2004), Sondergaard and Turner (2008), Sondergaard and Winther Christensen (2006), www.agrisci.org/ny (2008a), Zeeb and Schnitzer (1997)	Relates stabling provision and management practices to equine behaviour and welfare	Limited practical study to determine conclusions and recommendations

Chapter Three

Literature Review: The Stable

This literature review introduces a number of important and relevant factors relating to this research thesis, concerning the stable; evolution; design and construction; and stable Fitness for Purpose, thus allowing for all important factors to be considered prior to the fieldwork being undertaken. The literature will adhere to the research objectives, providing a framework within which the research will develop to reach conclusions.

3.1. The Evolution of Stables and Stable Yards

Stables throughout time have been built for a variety of reasons, and utilised a variety of locations and materials. Over time a great variety of stables and yards have been built across the UK for private and commercial purposes, unfortunately not all remain today.

Harris (2005) describes that the stable is a building, buildings, or portion of a building that is used for housing and feeding horses, cattle and other domestic livestock. Stables are described by Peters (2003) as being divided into two distinct types utilised by different types of horses: the wagon horse used for agriculture or draught work; or the hackney horse used for riding or carriage work. In contrast Powell (1991) designates stables into three distinct areas: farm stables designed and built by local craftsmen; stables built with houses, which were consciously designed; and lastly business and institutional stables which were plain and designed for functionality. For the purpose of this thesis the description utilised by Harris (2005) will be utilised as provides the most encompassing terminology for stables. However cattle and other domestic livestock will be excluded from this analysis.

3.1.1. Design and Construction of Working Horse Stables

Early records of stable yards include a hunting lodge for Edward the First at Clipstone, Nottinghamshire in 1282, though no evidence of this structure remains, and there is limited evidence remaining of stables of a similar date to this example, one example being Oakham Castle, Leicestershire, a thirteenth century fortified manor house, described as having a hall, four chambers, a kitchen, two stables, a garage for hay, a porter's chamber, a draw bridge and a garage for prisoners, though details of the stables are not included. (Powell, 1991).

The fourteenth century South Wingfield manor in Derbyshire, (originally owned by Ralph Cromwell, the Lord Treasurer to King Henry VI) is described (Gotch, 1985) as having ample accommodation including two large courts, the northern (inner) court containing a hall, kitchen and family chambers, the southern (outer) court containing barns, stables, guard-houses and other "inferior" buildings thus describing the segregation of living accommodation and allied facilities. A later property, Brome Hall in Suffolk dating from 1580 was described (Powell, 1991) as having a stable court of a symmetrical design, but no further detail is given. Later Palladian style properties such as: Blenheim Palace, Oxfordshire; Castle Howard, Yorkshire; and Seaton Delaval, Northumberland; demonstrate a symmetrical wing design, one wing containing the kitchen and the other wing containing the stables. A similar design was illustrated in Isaac Ware's work "Complete Body of Architecture" dated 1756, showing a house with two wings, the left containing the kitchens and the right the stables (Powell, 1991).

The National Trust own and manage a number of key properties with historic stable yards (Greeves, 1989). Penrhyn Castle, Bangor, North Wales has a sizeable stable yard beyond the back gates of the property. The yard extends to stabling for 36 horses, with Penrhyn slate used between the stalls and for the mangers, as the yard was commissioned in 1820 by G.H. Dawkins Pennant the owner of the Penrhyn slate mines. Other notable properties with stable yards include: Templetown Mausoleum in Co Antrim; Tyntesfield, Somerset; Uppark, West Sussex; and Willington Dovecote and Stables in Bedfordshire, which was built in the 16th Century by Sir John Goshawk, Cardinal Wolsey's Master of the Horse (Greeves, 1989).

Early farm stables are described (Peters, 2003) as a single stable which provides accommodation within for three to four horses with the horses tied in a row in line with the roof ridge, providing shelter under a simple roof span. Where larger numbers of horses were housed these tended to be positioned in two rows (tail to tail) with a central access alleyway. It was common for the stables to be built utilising a common gable wall with another building. During the late 18th and early 19th century it became increasingly popular for farm horses that were doing lighter work to be kept in stables (rather than stalls) with lofts above for storage and accommodation, and also providing additional insulation. The quality of the buildings utilised as stables on farms suggest that the stables were considered one of the most

important buildings, frequently surpassed in design and construction only by the farm house (Peters, 2003).

Stables on farms commonly utilised a floor to ceiling height of eight to nine feet (2.5 – 2.7 metres) with large windows and wide doorways (Powell, 1991). The building materials tended to be local, thus limestone in the Cotswolds and flint in Norfolk. The use of local materials reduced during the 19th century as transport links improved material availability, thus the use of hard brick and thin regular slate or clay tiles became increasingly popular. To aid longevity of the buildings, stone lintels above windows and doors began to replace the use of perishable wooden lintels. It is suggested that early examples may have been thatched, but very few thatched stable examples remain today (Powell, 1991).

Glendinning and Wade (2008) describe farm buildings across Scotland and include information concerning the design of stables used for both the farm working horse, and the riding horse. The earliest description is of an early seventeenth to mid eighteenth century stable. The stable is described as an open fronted byre with no internal partitioning, with a platform above the horses for the male servants to sleep on. A horse shade is also noted, which appears to provide shade, but little further weather protection.

Model farms developed throughout the eighteenth and early nineteenth century, and though there were a number of variants the model farm had the common theme of being symmetrical and ordered. Variants include: the Palladian with pavilions and links, and spires, clock towers and dovecotes as central pieces of interest; Neoclassical which avoided grand centre pieces (as above) but were uniform and homogenous in order; and romantic or medievalising with a castellated circular or semi-circular courtyard commonly referred to as Robert Adam (1770 – 1800) style. Glendinning and Wade (2008) state simply that the best stables are sheds with doors opening outwards and situated away from the full sun - which blisters the paint and dries the wood of the building.

Powell (1991) describes the historically common use of stalls within larger stables, with wooden partitions between the horses. Common stall spacing for farm horses being between five to six feet (1.5 – 1.8 meters) with partitions higher at the head end than the tail end to reduce aggression between stall-mates and a floor sloping to the rear to aid drainage. During the Victorian era non-slip fired clay paving was utilised

increasingly as a floor surface, with specialist drainage equipment and the use of ventilator systems. It is stated (Powell, 1991) that at this time the care of the horse became increasingly humane, and the stables lighter and cleaner. During 1805 Robert Somerville stated that East Lothian buildings which were being used as stables were being improved with horses being stalled rather than kept in open stables (Powell, 1991).

Peters (2003) describes similar factors to Powell (1991) and also that stables used for horses could be clearly identified (over those used for cattle) by the windows and ventilation provision demonstrating the importance of the horse over that of the cow. By the mid nineteenth century, stables commonly had shutters or louvres, or as a minimum ventilation slits, and commonly hay lofts above, though the value of a hay loft was questioned as it reduced ventilation but did increase insulation - though ceiling heights of eight feet or more allowed adequate ventilation and air circulation (Peters, 2003). Stalls were built to accommodate one or two horses (two would be a pair of work horses used to working together), wooden partitions of five to six feet apart were utilised, with a trough, tethering ring and rack for feed at the head of the stall. The trough would be positioned at three to three and a half feet high and built of wood, brick or stone, the hay rack above being timber. Behind the horses (on the rear wall) would be cupboards, racks and boxes for the storage of harness and equipment as it was unusual to have a separate harness room (Peters, 2003).

An unidentified farmstead in Berwickshire dating to 1809 has a clear division of riding and working horses, with a working horse stable containing 8 stalls and a riding horse stable containing 4 stalls, though unfortunately no dimensions are given (Glendinning and Wade, 2008). A stable design at West Fenton Farm in East Lothian dating to 1839 has a separate tack room and also a building containing 5 separate stables with a corridor to the front of the building for access to each stable (Glendinning and Wade, 2008).

Glendinning and Wade (2008) provide extensive plans for Balmadines Mains Farm (Scotland) dating to 1844. The plans illustrate work horse stabling measuring 73 x 18 feet (22.25m x 5.48m) that contained: 12 stalls with a walkway behind and a door way centrally along the front of the building, thus making each stall less than 6 feet wide (1.82m); four hammels for young horses, (a hammel being feeding pens for groups of animals); a horse pond to provide water for both drinking and for washing; extensive landscaping; and an extensive system of liquid manure drains. A plan of a

similarly aged stable (Glendinning and Wade, 2008) includes stabling for five horses in a single stalled stable measuring 26 x 16 feet (7.92m x 4.87m), thus providing each horse with a stall just over 5 feet wide (1.52m) (Glendinning and Wade, 2008).

Stephens (1852) is quoted by Glendinning and Wade (2008) in "The Book of the Farm" that stable buildings are too narrow, and should be at least 5.4m (17 feet 8 inches) wide, windows should be kept open and it is inadvisable to utilise haylofts above stables as this reduces the roof ventilation considerably. It was concluded by Glendinning and Wade (2008) that these suggestions did not become common place until the mid nineteenth century, though there were examples of early improvements, including those at Denbrae, Fife, where a refurbishment in 1870 included a new tiled roof and the inclusion of ventilators.

During the period between 1850 and 1914 many developments occurred in the field of architecture and also technical details concerning the farm and stabling design (Glendenning and Wade, 2008) John Starforth, an Edinburgh architect was awarded a Gold medal at the Highland and Agricultural Society of Scotland show in 1853 for his innovative designs for farmsteads. It is stated that these designs demonstrated classical regularity, but tended to have a task driven logic which had been overlooked to some extent previously. The designs commonly included a shed and yard for young horses, two working horse stables and a riding horse stable containing stalls, harness room situated between the riding horse stable and the working horse stable and a hay house (Glendinning and Wade, 2008). Around the time of John Starforth's designs, the knowledge of the importance of dry conditions and well ventilated housing for working and riding horses increased, and also that the practice of tying work horses in pairs in larger stalls became a "trevises". Larger farms developed the practice of placing two rows of stalls in a stable with a central passageway so that the horses were positioned tail to tail. The flooring tended to be hard cobble, flag or brick, sloping towards a drainage channel. Doors and windows tended to be of the "hit and miss" design to increase ventilation, and additional ventilation was provided by vents in the roof, often manufactured in cast iron by local foundries (Glendinning and Wade, 2008).

Following the end of the "high" farming period agricultural mechanisation on farms increased, and horse numbers declined. Post World Wars I and II (1946) a government committee recommended that Scottish crofts of an average two – four hectares would require a cart shed, two horse stables (no size was stated), a straw

barn and two cow byres (Glendinning and Wade, 2008). As agricultural mechanisation continued to increase and working horse numbers decreased many stables became redundant, with many being diversified over time into a specific leisure equine purpose, thus utilising the stabling facility for a different type of horse than it was originally planned for (Glendinning and Wade, 2008).

Stables of the East of England are described extensively by English Heritage (2006) in the document concerning historic farmsteads. It is stated that the barn is the oldest building found at a farmstead, with stables being the second oldest buildings. The importance of the horse is reflected by the stables being positioned conveniently for both the house and the fields; and also the architectural and decorative workmanship incorporated into the building fabric. It is stated (English Heritage, 2006) that few examples of stables prior to the 1700's exist due to the limited use of the horse at that time, as the common work animal was the ox. Stables dating from the 18th century were more common due to the increased use of the horse, and the allied decreased use of the ox.

It is stated (English Heritage, 2006) that the size of the stabling, along with the size of granaries and cart sheds were directly linked to the acreage of the farm itself, one work horse being required for every twenty acres (8 hectares) of farm land, though on small farms a team of horses was still required, so farms of less than fifty acres would require at least four horses. These figures remained static until the demise of the horse and the increased use of the tractor, with most farms maintaining the use of the horse until the 1950's and some into the 1960's.

Stable interiors are stated by English Heritage (2006) to allow for the working horses to be stalled as pairs with wooden partitions preventing the pairs of horses kicking the adjoining pair. Cast iron fittings replaced wooden fittings with the most elaborate fixtures and fittings being seen in stables for riding horses rather than cart horses. On smaller farms the riding horses and the cart horses may have been stabled together. Stable buildings were utilised differently over time; commonly pre 1750's stalls were positioned across the inner end wall of a stable building, (Figure 3.1) with later stabling utilising stalls along the inner side wall, (Figure 3.2.) thus allowing for an increased number of horses to be accommodated.

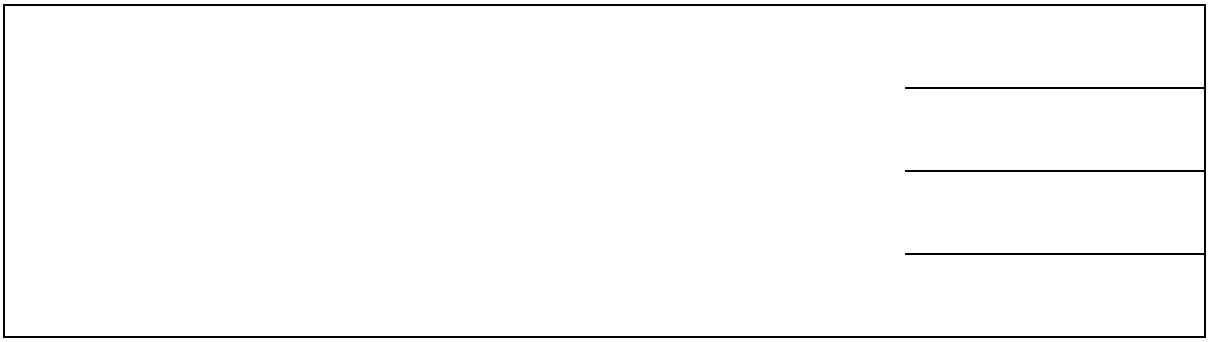


Figure 3.1. Stalls along end wall (Common Pre 1750's)

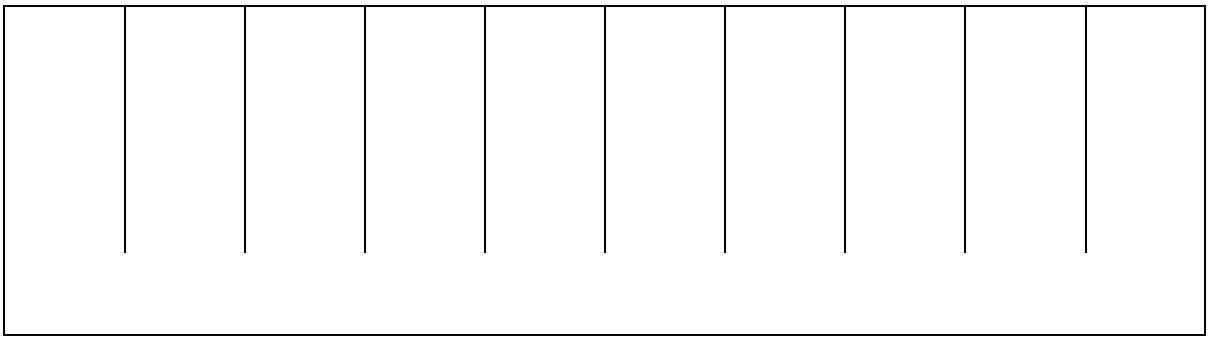


Figure 3.2 Stalls along side wall (Common Post 1750's)

Changes also included the flooring materials utilised; changing during the mid nineteenth century from cobbles to manufactured engineering bricks, sloping into a drainage channel. Separate hay racks and mangers also changed during the mid nineteenth century as feeding practices changed to incorporate a wider range of feedstuffs, including crushed oats and bean straw (English Heritage, 2006).

Changing practices (English Heritage, 2006) also included the decreased use of the two storey stable block, with accommodation above, to single storey buildings with cast iron ridge vents demonstrating the increased understanding of the importance of ventilation, and also the use of windows (opening to the East) to allow the building to be well lit and catch the morning light. This is contrary to the same source (English Heritage, 2006) that "despite textbook advice on the tainting of the hay, the practice of housing horses below haylofts persists, partly because of the perceived need to protect horses from chills and draughts".

The English Heritage (2006) document refers to the common Norfolk and Suffolk practice of utilising horse-yards at night. It is stated that this was a common practice to reduce the time horses spent in stalls, and was commonly referred to as the "Midland System". No further reference to this practice has been found, but it appears to have similarities to the Shetland punds referred to by Glendinning and Wade (2008). The pony pund is described as (Glendinning and Wade, 2008) a

relatively common structure found on the Shetland Isles. The pony punds were largely built in the early 19th century when large numbers of Shetland ponies were being bred for utilisation in coal mines. The pund would be constructed of low stone walls, a large structure, usually square with internal sub divisions for ease of care and management of the breeding stock.

Stabling was necessary for a variety of other industrial and commercial horses, ponies and donkeys utilised at this time (Powell, 1991). Inland waterways used horses for haulage purposes, and canal stables could be found along the waterways network, sometimes being attached to a public house also providing human accommodation. Railways utilised horses for short distance haulage mainly from the railhead to the customer. In 1914 it was estimated (Powell, 1991) that the Great Western Railway (GWR) owned over 20,000 horses, many of which were housed in single storey stables painted in distinct GWR colours. The understanding for good quality stabling for commercial horses is mentioned (Powell, 1991) referring to railway stabling at Park Royal, Ealing, where a stable of twelve stalls and a feed store had what was termed as ample ventilation provided by window vents, high and low wall vents and also roof ridge vents.

London also contained many stables for horses utilised within warehouses and other commercial enterprises. A warehouse in Charles Street, Drury Lane built in 1884 is described as having twelve stalls, four stables and a harness room on the first floor, reached by an unroofed shallow ramp. A larger warehouse owned by Crosse and Blackwell in Crown Street, Soho in 1876 provided ground floor stabling (it is not stated if this was stables or stalls) for four horses, a fodder store and space for eighteen vans. The first floor contained stalls for thirty five horses, one hospital/sick stable, fodder store and stableman's rooms. Costermongers stabling in Bethnal Green (1877) is described as provided stabling in stalls for fifty donkeys and ponies utilised in the Columbia Market. The provision basically described as a corrugated iron structure with timber partitioning (Powell, 1991).

Powell (1991) states that by World War I stabling was no longer worthy of decoration and was built specifically with utility above appearance. The design focus became labour saving and began to incorporate design features such as utility stables for grooming and clipping and the use of concrete blocks, timber framing and cladding, and demonstrated the use of lower roofs and ceilings and the common addition of a

front overhang. It is stated that the accommodation lost character but that the living quarters for the horse became increasingly healthier.

During the twentieth century significant stable losses occurred. The use of the working horse reduced considerably, corporate ownership of large numbers of horses had been largely, though not wholly replaced by large numbers of people owning a small number of horses, and there had been a large loss of business and industrial stables as a result (Powell, 1991).

3.1.2. Design and Construction of Riding and Carriage Horse Stables

Wothorpe Lodge, Cambridgeshire, built in the early 17th century for the Earl of Exeter is considered the earliest surviving example of a Classical Stable in Britain. The stables being stylistically innovative, built on the plan of the Greek cross with four octagonal towers. This large stable range having elegant Doric plastered door cases, sophisticated windows, and classically moulded doors and windows (Worsley, 2004).

During the affluent mid 19th century the numbers of riding and driving horses increased, thus did the necessary provision for their stabling. Allied to this, the quality of the fixtures and fittings increased, thus riding and driving horses stabling increased in quality over and above that of the working horse. Improvements in quality include internal plastering, boarded lining to walls, cast iron rather than wooden hecks and troughs and better quality hard floors (Glendinning and Wade, 2008).

Powell (1991) describes stables associated directly with houses as being the most splendid of stables; spacious yards built with entrance arches and clock towers, reflecting the glory of the houses they adjoined, and reflecting the occupants position in society. Examples of such elaborate, and subsequently lost houses and stables being: Wollaton Hall (1580); and Welbeck Abbey (1625); both in Nottinghamshire (Powell, 1991). Styles changed during the Georgian era, with wealth and stable size both increasing. Symmetrical Palladian designs with colonnades to flanking wings became common, stables and ancillary buildings occupying the wings. It became increasingly popular to use blocks of stables containing varied numbers of stalls grouped around a courtyard. Lathom Hall, Lancashire having twenty eight stalls within five rooms (stables) and Moor Park in Hertfordshire having thirty eight stalls within six rooms (stables) (Powell, 1991).

Country house stables were becoming increasingly complicated throughout the Victorian and Edwardian era, with each activity becoming separate; carriage horses, hunters, riding horses and visitor's horses being housed separately. Improvements including the provision of draft free ventilation and damp free floors were increasingly utilised. South East facing stables were preferred at this time, with large windows, eleven feet (3.35m) high ceilings and additional ventilation provided through tubular vents in the roof. Flat brick floors were increasingly common over previously utilised sloping floors, and stables were increasingly preferred to stalls, stables being built without central gangways, thus improving light and air provision, and utilising tiled walls and non-absorbent ceilings to improve hygiene. Separate harness and saddle rooms were included in designs, along with open fronted grooming sheds, and horse baths with capacious cisterns and shower bath fittings. The use of the clock tower was considered essential at this time (Powell, 1991).

Country house stables and some commercial and institutional stables became increasingly elaborate and increasingly expensive to build. During 1865 a small terraced house cost approximately £100 to build. An unidentified stable yard for fifty four horses built at this time cost £3,460, equating to £288 per horse. Lyme Hall, Cheshire had a new stable yard built in 1864 which has been referred to as an elaborate establishment, with eighteen loose stables, four stalls and the use of glazed wall tiles, costing £5,000 (Powell, 1991).

As stables became increasingly elaborate (Powell, 1991) in design and architecture, including the use of pinnacles and battlements at Scarisbrick Hall, Southport (1837 – 45), the interiors became equally elaborately equipped. A renowned example of interior workmanship being Marlborough House, London completed in 1863. The forty five stalls and twelve stables are referred to as being excellently equipped with coloured iron fittings, vitreous enamelled corn bins, friction rollers to prevent biting of the edge of the bins and mangers within the stables, and specialist devices to prevent the head becoming stuck in hayracks, though unfortunately no details of the exact design of these devises exist today. Powell (1991) further describes a much smaller yard built in 1868 in Walton-On-Thames which utilised experimental concrete walls, patent revolving door shutters and combined roof ventilators and lantern lights with plate glass louvres. This may have been one of the last examples of elaborate country house stables, the early 1870's marking the decline in major house construction and the allied decline in elaborate display elements of stable design,

resulting in projects being built in a more moderate fashion. Detailed costings for a stable yard built in 1865 can be found in Appendix 2.

Urban stabling was also going through changes in design and construction, with the use of stabling within a mews becoming increasingly popular. Lord Derby commissioned Robert Adams to design housing and stabling at Grosvenor Square, London in 1773. The stables themselves had less architectural display elements than those utilised in rural stabling of the time, the stables being packed closely together at the back of the houses, usually a narrow row of eight stalls and a wider row of three stalls thus indicating a distinction between the status of horses (leisure and coach/carriage) within the household which was reflected within their housing arrangements. Above the stables was a hay loft, and adjacent a coach house with space for two coaches, and a coachman's flat above (Powell, 1991).

Powell (1991) states that during the 1870's a change to less elaborate stable yards coincided with a general improvement in the horses accommodation. Space for each horse increased, as did the use of the stable (usually measuring 10 x 12 feet) (3.04m x 3.65m) over that of the stall, and where provided there was a marked increase in the number of hospital/isolation stables to prevent cross infection. Where stalls were utilised it became common to install extendable partition poles to prevent a loose horse making a nuisance of itself and for heel posts to contain additional ventilation ducts. The use of the L shaped block became increasingly popular for smaller developments, displaying stables, stalls, wash and sick stables with direct yard access and no gangway in one wing, and the coach house and harness room in the other.

Elaborate rural or more modest urban private yards were in significant contrast to the business and industrial stabling provision which demonstrated a simpler more functional provision. Early business stables were those attached to the medieval inns dating from the 1500's onwards. Popularity increased during the eighteenth century due to the increase in turnpike roads, by the mid eighteenth century it being common for coaching inns with stabling to be found every twelve to fifteen miles, and within every market town (Powell, 1991). Coaching inns are described by Powell (1991) as having an urban Georgian Façade and generous proportions with open access into a yard surrounded by stabling and allied buildings. The decline of the coach from the 1830's mirrored the increased use of the omnibus horse, the omnibus horse stabling provision being described (Powell, 1991) as basic, but not mean.

Accommodation was generally in simple stalls with a single partitioning wooden plank suspended by chains from the ceiling. There is reference to the lack of space within such stabling, and the need for the carriages to be housed on the first floor, with hoists to get them there, the horses being stabled on the ground floor underneath.

Stable construction is described by Worsley (2004) with regard to artistic interest rather than the management of the horse. The 2004 work largely reflects Worsley's PhD thesis entitled The Design and Development of the Stable and Riding House in Great Britain from the 13th Century to 1914 (Worsley, 1989).

Details of early stabling construction are sketchy, with minimal examples remaining, though detail can be deduced concerning the use of the horse and the lifestyles at the time from the literature which is available. Monastic stables at Bury St Edmunds demonstrate an early indication of the awareness of the risk of fire, and preventative measures taken to reduce the risk, Abbot Samson (1182 – 1211) ordered that the stables and offices around the court covered with reed should be re-roofed and covered with tiles (Worsley, 2004). Worsley (2004) describes that by the mid 1300's there was a large monastic stud at Beaulieu Abbey in Hampshire, housing over three hundred and eighty horses, including mares, foals, colts and it is assumed stallions. These were not housed in a single location, but across seventeen granges associated with the Abbey.

The use of a variety of flooring is evident from the 15th century. Farleigh Castle, Somerset, built in 1425 had a floor of natural bedrock with stone slabs. Kirkstall Abbey, Leeds, had stone flags, and the floor at Tattersall Castle, Lincolnshire (1439) was brick paved. Water Hall in Suffolk (1473) had an earth floor, where as wooden plank flooring was popular until the 17th century and is evident at the old deanery in Salisbury, Wilts. Allied to the flooring described above, drainage was also evident in many locations, Kirkstall Abbey having a gutter nine inches wide and six inches deep, and running into the main monastic drain system. Allied to drainage, Carew Castle, Pembrokeshire had its own piped stable water supply with the source over a mile away, and at Reading Castle pipes are referred to also (Worsley, 2004).

Worsley (2004) describes that the common method of stable drainage in the 1600's is maintained as a main drain behind the partition, with the stables at Petworth, West Sussex having a tap allowing the stables to be washed down. Planked flooring was still in common use, though the material was falling out of favour, and no examples

survive today. Alternatives included stone, cobbles, and brick. The common prejudice against the continental practice of using paving was that it was cold, would wear the shoes, and bedding would cost twice as much, but Blundevil was convinced that this option was better than planking due to it being non-slip, and half the cost to maintain. Clifford (1585) describes the use of compact gravel, sand and stone; de Grey (1639) pitched flint, and it appears that cobbles were still common, though difficult to clean and produced an uneven foothold. Clinkers were also utilised, being bricks placed upon the edge, making them easy to walk and lie upon.

Clarendon, Wilts, built as a royal hunting lodge in 1272 having racks with mangers below. Clarendon also having distinctively separate harness rooms for the King and the Queen, as described at Clipstone, Notts. Partitions within the stable appear not to be common at this time, or evidence may be limited due to the use of insubstantial materials such as wattle (Worsley, 2004).

The stables at Clarendon, Wilts are referred to as being between sixteen (4.87m) and twenty feet (6.09m) deep, and eighteen feet (5.48m) wide. This would indicate that the stables are used by more than one horse at a time. Haylofts over the stables were common, as was storage in an adjacent barn (Worsley, 2004). The Notebooks of Leonardo Da Vinci (1888) describe stable construction ; the stable being split into three equal sections, each being 6 braccia (approximately 8.5 feet/2.59m) wide, and the depth being of no significance, the end two divisions for the horses and the middle division for the horseman (Da Vinci, 1888). Limited information is provided on the fixtures and fittings of early stables.

The use of tiles increased, allied to the decline in thatch. Blundevil (1565) stated that windows should be glazed or latticed to reduce birds getting in, as their feathers and dung were dangerous to the horses, the stables built at Blickling, Norfolk built in 1622 being completely glazed (Worsley, 2004).

Worsley (2004) states that during the late 16th century and the early 17th century significant improvements were made with regard to stable construction, particularly regarding divisions and partitions between horses, hay racks, mangers, water facilities, flooring and drainage. Partitions were commonly simple hanging bales, as referred to in Leonardo da Vinci's "Medici Stables". These were described as being positioned between the manger and the heel post. Blundevil (1565) also recommended their use. Dunster Castle in Somerset, built in 1617 by George Luttrell

for William Arnold illustrates bare brick and stone walls, with elegant heel posts carved as chess pieces, and a short partition at the head end, close to the manger and hay rack. North (1581) preferred the use of bales to solid partitions stating "*for the horse do e not love to be recluse, but hanker after the enjoyment of their company, which is by eye, and so have pleasing converse*". By the early 18th century the use of bales was out of favour, and the use of partitioned stalls commonplace with the standard sized stall preferred by North (1581) and Clifford (1585) being five feet (1.52m) wide.

During the 1500's innovation was made with regard to hay rack design. The hayracks were increasingly substantial, with vertical bars. The hayrack positioned 1 ½ feet (0.45m) from the manger, and the manger 3 – 4 ½ feet (0.91 – 1.37m) from the floor, making it easy for the horse to eat and less likely for dust to fall into the horses eyes, but increasingly expensive to build. This design became the standard in the better class of stable during the 17th century (Worsley, 2004).

Separate saddle and harness rooms were rare until the 16th and 17th centuries. Up until this time simple pegs or chests behind the horse would have been used, and equipment stored in the grooms bed chambers, generally above the stables, making security limited, though junior grooms did not generally have their own bed chambers, but slept with the horses. Ordinary saddles were even stored on string hung between the windows, with only the better harness and saddles being stored in a more secure location. Early saddle rooms were built at Old Thorndon Hall, Essex in the 1580's, Nonsuch, Surrey in the 1590's and Hengrave Hall, Suffolk in the early 1600's (Worsley, 2004).

Worsley (2004) describes the problems with stabling concerning the increased use of the coach, mainly that the pony or "palfrey" or the general riding horse was not strong enough to pull the new coaches and as many as a team of six horses would be required, and thus horses suitable to pull the coaches were developed and increased in number, with stabling requiring alteration to accommodate them. By the 17th century country houses were adding new, architecturally distinctive stables to house the eight to ten required coach horses, and allied coach houses.

During the early 16th century the use of "riding houses", today referred to as indoor schools or arenas were in their infancy. Much was written by Worsley (2004) concerning the development, design and use (for Hautè Ecolè) of the riding house,

which though allied to the design and construction of the stable yard frequently had little connection to the rest of the design, and thus will not be examined in detail within this thesis.

Stable construction developed further during the Stuart period. Worsley (2004) describes the stables at Fonthill, Hampshire as being made up of a nine bay building with a five bay central range flanked by two bay projected wings, with central pedimented door case, mullions and transom windows on the ground floor and oeil-de-boeuf windows above, with a hipped roof. The appearance was commonly mistaken for a country house, but unfortunately the architect is unknown. This demonstrates the increased popularity of oeil-de-boeuf windows due to their classical yet practical use. Oeil-de-boeuf windows were particularly relevant to haylofts which required light and ventilation, as casement windows were too large, but oeil-de-boeuf windows ideal.

Worsley (2004) describes the greatest stables of this time to be those of William Cavendish, Earl, subsequently Duke of Newcastle. Cavendish, educated at the Prince of Wales Stables, Richmond, commissioning John Smythson in 1625 to build stables at Welbeck Abbey, Nottinghamshire. The stables were innovatively vaulted in stone to reduce the risk of fire, had stone heelposts and mangers described as "I'Italiene". There were distinct areas for feed preparation, shoots from the hayloft above, and running water underneath the stables to remove waste. Each stall had a small ventilation shaft at the front to remove exhaled breath, which could be opened or closed depending on the temperature. The grooms were provided with heated harness rooms, and heated bed chambers in the attic space.

Shortly afterwards (1630's) Cavendish commissioned John Smythson (Watkins, 1979) to build further stables at Bolsover Castle, Derbyshire. The stables were constructed entirely of stone, with a series of gabled dormer and casement windows with classical architraves and rusticated door cases. Jenkins (2009) describes Bolsover Castle as having a riding house round an inner courtyard, with a shoeing hall and stabling, but unfortunately there is little detail concerning the construction of the stables.

Views on the construction of stables at this time vary, with literature recording the opinion that the construction was not always to the horses benefit. Gerbier (1662) states that "*stables [were] built for display and prestige, as much as horses*" and that

"*display is best achieved by placing horses in a double range of stalls along both sides of a stable*" It is stated that to stand the horse on a slope of six to eight inches (15.24 to 20.32cm) is not for comfort or convenience, but that the higher the horse stands towards the manger, "*a better sight it is, especially when the lights of the stable strikes on the horse their backs*" (Worsley, 2004).

North (1581) continues concerning sloping floors, stating that "this looks great, but the masters ostentation is not for the horses health; the place is cold and noisy, nothing stirs but the room is disturbed, and a horse is a watchful creature and hearkens after all that passeth". De Grey (1639) writes that if the horse stands higher than its master its legs will swell, and he will become lame, causing it pain and grief.

By the early 18th century Dunham Massey in Cheshire demonstrated dramatic change. Dunham Massey initially had early 17th century stables and timber framed buildings, which were removed and new stables built at the side of the house. The stable was a thirteen bay brick building, with stone dressings, projecting wings, pedimented centrepieces, and oeil-de-boeuf windows (Worsley, 2004). The later part of the eighteenth century saw greater changes in the horses themselves, as the types and breeds were changing due to the development of the Thoroughbred for hunting and racing, which therefore required allied changes to accommodation (Worsley, 2004).

Notable houses where the original stables were replaced by distant quads included Burton Constable, Yorkshire, Ragley Hall, Warwickshire and Harlestone House, Northants. Stables at Attingham Park, Shropshire, built in 1785 had conventional domestic windows, cornice round the interior and heelposts topped with urns. The rack and manger were single wooden structures running the full length of the building, thus stalls not separate stables were accommodated (Worsley, 2004).

The use of a single wooden manger was outdated by the end of the 18th century when metal racks became the norm due to being harder and more resilient than wood: cheaper to produce; and replace; and requiring less space. Metal racks can be seen at Wentworth Woodhouse, Yorkshire, and also at Ribston Hall, Yorkshire. Mangers were commonly leather, as seen at Houghton Hall, Norfolk, the exception being at Penryn, Wales, where slate was utilised (Worsley, 2004).

Around the increased popularity of the stable and the demise of the stall much was debated concerning the subject of ventilation, draughts and air flow. Markham

(1607) argued against the provision of ventilation, stating that horses were better kept “temperate and warm”. Smells and vapours were prevented by the burning of Storax or Benjamin, sweet smelling gums twice a day. Gibson (1721) integrated features into his construction to reduce draughts, but also to increase air flow, including the use of high windows to reduce direct draughts, using a large half lunette in the Diocletian style. William Ellis (1750) stated in his publication, The Modern Horseman that bad ventilation is so harmful that thick skinned horses should be kept out of doors all year round, with a shelter for protection, a management method utilised at Great Gaddesden, Hertfordshire. James Clarke (1788) refers to the fact that closed stables are still the norm, rather than the exception and are the main cause of illness. He appears to be the first stable designer to approach the subject of ventilation in a scientific manner. Even in 1796 John Lawrence stated that it is still fashionable to keep horses too hot, neglecting to air the stables and when the stables are empty they are enveloped in a hot mist, making the eyes water because grooms were adverse to leave even a crack open thus allowing the foul air to escape (Worsley, 2004).

By the early 19th century hygiene, ventilation and drainage dominated the literature relating to stable management. Mills (1776) advocated holes in the ceiling to allow air to escape, White (1802) suggested adjustable apertures in the ceiling, Lugar (1807) advocated ceiling ventilators, and both Lawrence (1816) and Lawson (1825) the use of six inch tubes through the roof (Worsley, 2004).

The suggested improvements concerning ventilation appear to have been adopted quickly. Sloan included ventilation tubes for Albury Park, Surrey, Henry Holland included two copper ventilation spinners in the roof at Southill House, Beds. Wyatville, at Endsleigh, Devon, used ventilators in the ceiling above each window and door, and pipes to convey the foul air away, as well as utilising dormer windows. These, and similar features became commonplace in the early 19th century. (Worsley, 2004). Drainage construction illustrates improvements, traditional stalls having a covered drain in the centre of each stall linking to a main drain at the back of the stalls. This was an advancement on the open drains seen previously at the rear of the stalls. An innovative use of drainage is noted at Albury Park (1805) which contains drains, a cess-pool and a ventilator system (Worsley, 2004).

In 1844 William Miles published the second edition of General Remarks on Stables and Examples of Stable Fitting, the 5th Edition being published in 1901. Building

News published a variety of stabling related articles, Volume 70 contained two articles on the use of noiseless paving stones, Volume 71 on sanitary construction and fitting of stabling, and Volume 72 contained a series on stable construction (Worsley, 2004).

It appears that ventilation and sanitation were now seen as an important horse health factor. Miles (1844) in the second edition of General Remarks on Stables and Examples of Stable Fitting divides the importance of stable design into three areas: the general appearance of the stable; the convenience for the groom; and lastly the accommodation of the horse. It is stated that a horse kept in a well lit, well drained and ventilated stable with room to move will increase its working life and reduce its feed intake, whereas a horse tied badly in a vitiated atmosphere will be dull, lifeless, dispirited and depressed. Miles (1844) has a number of ideas, both in agreement and also in contrast to other authors of this time. These points include having mangers in the same corner of each stable/stall to prevent the horses disturbing each other by eating on either side of a partition, using wood for mangers as they are not as cold as iron and having a white wear pottery water trough in each stable/stall with a separate cistern system to feed each with a pipe from the loft. Ventilation should be ample and continuous with light provided by sash windows and gas lights should be limited in use because of air quality reduction.

Miles (1844) goes on to state that ideally stables are divided into four apartments, the stable being of greater value than the stall as they are beneficial in terms of humanity and compassion with the horse being imprisoned in a stall for seven tenths of the time, with reduced natural movement which causes physical deterioration, disability and lameness. Drainage being important: effective enough to carry urine away quickly; with the common use of the bell-trap discontinued.

Birch (1883) states that good drainage lies in cleanliness levels and that clinker bricks moulded into drainage channels were both durable and provided grip but were expensive. Blue Staffordshire or Broseley bricks were a cheaper option and ordinary bricks cheaper still, but were porous and would wear unevenly. Pebble pitching was cheaper and stated as the most common flooring in the 1860's.

The 19th century saw iron racks superseded wood which was considered unhygienic, iron being easy to clean and not chewable. The 19th century also favoured an iron partition with a grill above so that the horses could see each other. Mayhew (1864)

utilised these in the design for the Royal Mews at Buckingham Palace. The partitions were also not placed directly onto the ground, but raised a few inches off the ground to aid air flow through the building (Worsley, 2004). In the compilation publication of 1850, the section titled “Hints on how to keep horses” (Anon) recommends that the stable should have no racks, as racks are filled and the horse is encouraged to over eat as a result, thus overloading his stomach, and when he is worked his wind will be endangered. It is stated that a full hayrack is both injurious to the horse and a waste of provender.

Materials were selected due to functionality, expense and also practical application. Miles (1844) and Fitzwygram (1869) favoured elm as it was tough but warped; oak being the best material but expensive. The 19th century saw the use of tiles between the manger and the rack as hygienic and attractive. Grey to blue – green being preferred, with white considered to be too bright. The tile shape was square, hexagonal or octagonal, often with an ornate Greek key or rope boarder pattern. Marlborough House, Wiltshire contained marble slabs and the stables at Witley Park, Surrey, were completely lined with ceramic tiles (Miles, 1844 and Worsley, 2004).

Many stables in the Victorian period had the existing fixtures and fittings upgraded. This coincided with the move towards the stable rather than the stall, with it being standard for hunters to be stabled in stables by the 1870’s. This is illustrated by the new yard built for the Meynell Hunt, Derbyshire in 1873 with twenty three stables and only eight stalls (Worsley, 2004). Fitzwygram (1869) is quoted by Worsley (2004) as stating that there was little cost differential between the building and construction of stables and stalls but that there was a much greater space differential. Expensive fittings were used for hunters and other expensive horses, but carriage horses were still stabled in stalls as they were considered work horses. There were also allied changes in groom’s accommodation, the Georgian groom’s quarters considered poor, but by the Victorian era were much more extensive, with head grooms having separate accommodation and grooms accommodated above the coach house and not the stables so as not to disturb the horses.

Lighting and fire risk were of paramount importance to stable designers regardless of the time of design and construction. As early as 1534, fire destroyed the King’s stables at Charing Cross including horses and hay. In 1683 there was a fire in Newmarket which reputedly burnt down half the town. Loudon (1836) advised the use of candles in lanterns on cords to light stables, Miles (1844) discussed the use of

gas lighting, providing that a separate air provision was provided for fear of using all the oxygen in the stable. Armitage (1889) stated that gas lights were common though not in the stables themselves and that this method of lighting was both safe and effective. It is believed that the first electric lighting used in stables was that at Ingestre Hall, Staffordshire in 1892. Machell Place, Newmarket had three large water tanks for use in the event of a fire (Miles, 1844 and Worsley, 2004).

Heating in stables has been discussed by a variety of authors as referred to by Worsley (2004). Though it was common to use a blanket to keep the horse warm Knightley in 1862 suggested the use of hot water pipes positioned under the manger to heat the stable. Central heating systems were recommended by Mayhew in 1864 and by Coleman in 1897. The tack room at Badminton, Gloucestershire contains an extensive radiator network utilised for maintaining the tack at an optimum temperature (Worsley, 2004). Horse Turkish baths were utilised in designs over a wide time period. John Lawrence included a warm bath in a design of 1798. In the 1850's they were considered to be a luxury, but in 1861 Walsh and Lupton describes the fashion for sweating horses in Turkish baths and that these could also be utilised by the staff, a noted example of a human user being jockey Fred Archer (Worsley, 2004).

The last extensive stable complex of the 1890's was at Manderston, Berwickshire, built for Sir William Miller and designed by John Miller. Manderston has a stone pillastered archway, ashlar detail and lion tie-rings. The roof is barrel vaulted with a complex ventilation system, brass heel posts and mangers, the horse names picked out in gold on marble plaques above the stalls. The early 20th century saw the end of the building of large stable complexes in the traditional country house style. Ernest George and Yeates built what are considered to be the last at Foston Hall, Derbyshire and at Grathorne Hall, Yorkshire (Worsley, 2004).

3.1.3. Stable Size

Much is also written about the size of the stabling which is required. The Army Sanitary Commission (1862) calculating that as 600 cubic feet (16.99m^3) were required per soldier in a barrack room, 3,000 cubic feet (8.49m^3) was required per horse, though it can be noted from the information below (Table 2.4.) from a variety of stables that these requirements were rarely met (Coleman, 1897).

Table 2.4. Stable sizes

Royal Mews	2,500 cubic feet per horse	70.79m^3 per horse
Great Western Railway	1,116 cubic feet per horse	31.60m^3 per horse
Gentleman's Stable (average)	720 cubic feet per horse	20.38m^3 per horse
Mr. Birch's Omnibus Company	700 cubic feet per horse	19.82m^3 per horse
Cab horse stable (average)	550 cubic feet per horse	15.57m^3 per horse

(Coleman, 1897)

It is stated that the stables of the cab companies generally had the windows removed, and the doors were left open at night, contrary to the majority of the management of this time (Fitzwygram, 1886; Coleman, 1897).

Coleman (1897) further notes (Table 2.5.) the differences in stable sizes of a number of military stables:

Table 2.5. Military stable sizes

Hyde Park (new)	2,284 cubic feet per horse	64.67m^3 per horse
Woolwich	1,793 cubic feet per horse	50.77m^3 per horse
Regents Park (new)	1,461 cubic feet per horse	41.37m^3 per horse
Norwich	735 cubic feet per horse	20.81m^3 per horse
Dublin Royal Barracks	560 cubic feet per horse	15.85m^3 per horse

Coleman (1897)

The stable is described (Da Vinci, 1888) regarding bracchia, (amounting to approximately 17 inches (43.18cm), therefore being at least 11 feet high (3.35m), with mangers approximately 3 feet (0.91m) from the ground. The use of a hay loft above the stable is referred to (Coleman, 1897) with a window at the end of the building. A funnel system from hayloft to manger is referred to, to deliver the hay directly into the manger, and stone water troughs are described (Coleman, 1897) with a cistern of water above.

3.1.4. Stable Design

Following the Restoration in the 1660's it became common for stables to be designed in a single row, and not a quad as previous, with a central door, upright windows, either one or two storey's, with a hipped roof and dormer windows. The cupola was popular and maintained on stable buildings after being abandoned on houses by the end of the 16th century. The cupola was used, not as a viewing platform as in a house, but as a bell and clock tower, and a landmark in the countryside. An example of a post restoration stable was Cornbury Park, Oxfordshire, referred to as the first pedimented stables, designed for the Earl of Clarendon in 1663. The stables were fifteen bays wide and two storey's high with projecting pavilions, pedimented centre piece, ashlar stone and embellished niches in the pavilions and flanked by a central door. The majority of post restoration stables designed on a grand scale as miniature versions of the associated country houses, commonly with spiral staircases in the corners of the yard (Worsley, 2004).

The original stables at Houghton Hall, Norfolk were demolished in 1732, and rebuilt onto a William Kent design as two separate stables on a quad design, detached from the house. Each of the four facades having blank arcading, Diocletian windows, a pedimented entrance block and octagonal cupolas marking four corners. Internally the stables are tall and vaulted, with giant ionic columns topped with balls at the head and feet. Generally non-palladian houses had wings for offices and apartments, not for stables and farm activities (Worsley, 2004).

Worsley (2004) considers Hopetoun, Midlothian, to be one of the grandest stables in Scotland. It was built by John Adams in 1750 - 56, and designed with a large tower over the entrance and cupolas that appear to float over the stables. Tower like cupolas can be seen at Castlemilk, Glasgow, and Darnaway Castle, Morayshire, but also at Wallington Hall in Northumberland, the only English example, but the architect is unknown. Another Scottish design feature was the use of the steeple on buildings other than churches, which can be seen at Penicuik, Midlothian, built by John Baxter in the 1760's to the designs of the owner Sir James Clarke, and Blackadder Farm, Berwickshire having a wooden spire dating from 1785 (Worsley, 2004).

The designs of the 17th and the 18th century illustrate a change in the standard size of the stalls utilised, both in length and width. By the late 18th century the stall width was a standard six feet (1.82m), though at Camden Place, Kent, George Dance

(1807) utilises stalls six and a half feet (1.98m) wide. It is expected that the increase in the width of the stalls is due to the changes in the breed and type of horse being housed, this also being the expected reason for the increase in stall length, with a standard 17th century stall being eight feet (2.43m) long and the standard 18th century stall being nine feet (2.74m) long. The standard width of the passage behind the stalls being generally at least the width of the stalls themselves (Worsley, 2004).

During the 1780s hunting became increasingly popular, hunter numbers increasing, as did the literature concerning stable design and also what is referred to as the first real modern book on horse health "a Treatise on the Prevention of Disease Incidental to horses from bad management in regard to Stables, written by a veterinarian, James Clarke (1791). The greatest innovation at this time was the further use of the stable, sometimes referred to as a cage box, being a pen ten feet square (3.04m) which was favoured for sick horses and in-foal mares and those horses that worked hard, then were rested, for example race horses and hunters (Worsley, 2004).

John Lawrence, published A Philosophical and Practical Treatise on Horses in 1796, 1798, 1809 and 1829 recommended that all stabling be converted into individual stables, but this was strongly opposed by the grooms and horse keepers, though by the 1820's and 1830's the stables were in considerable use. Thomas Cundy is the first architect credited with the use of significant numbers of stables within his designs, including Normanton Park, Rutland (1803) and Tottenham Park, Wiltshire (1816). Sir Jeffry Wyatville used stables termed "loose stalls" in his design at Endsligh Park, Devon in 1810 and also at Ashridge Park, Hertfordshire in 1817; though the use of the "loose stall" was minimal, with a row of stalls having a single loose stall at each end, a design pattern which became the Victorian standard (Worsley, 2004). William Scott, in the 1818 publication British Field Sports states that the stable is the noblest of all remedies. This may have had an influence, as by the 1830's the stable was common place even in the designs used for the smaller country house (Worsley, 2004).

George Tattersall (1841) recommended stables fourteen feet (4.26m) square for a mare and foal or for two younger horses (to share) with each stable having its own yard area (thirty by twenty five feet/9.14m by 7.62m) enabling the horse to move about when not in a paddock. Ideally the paddock opening off the yard, allowing sharing between a number of e.g. stables. Tattersall (1841) preferring four stables per paddock. It is also stated that stallion stables should be built in pairs, positioned

as far away from mares as possible with each being fourteen feet (4.26m) square, with a twenty by twenty five feet (6.09 by 7.62m) yard, and that they must be as strong as elephant cages or would require constant repair (Worsley, 2004).

One stable of note of the early 19th century built by Loudon in Garth, Powys, was a circular Gothic stable with a veranda around the edge for exercising. At a similar time Lugars "The Country Gentleman's Architect" was published (1807) providing a pattern book of designs for kennels and hunt stabling. This was in response to the move of many hunts away from patron's country estates, to becoming subscriber led, necessitating the development of a unique hunt stable yard containing all necessary facilities for the working day of the hunt, including stabling, an example being the Warwickshire Hunt with subscribers George Lucy of Charlecote Park donating the site. Hunt and country house stables did retain similarities to, but tended to be more elaborate than racing stables, but the hunt stable would not include a coach house (Worsley, 2004).

Wheeler (1871) describes the use of the "Radiating Stall" or circular stable building, with the stalls all being centrally facing towards a feeding area, and there being a covered rear passage which could be utilised as an undercover exercise area. Haylofts were not included in the design due to the construction of the roof. Due to the design of the radiating stable, an allied building was necessary to house the coach house, and any stables which were required. Unfortunately, though Wheeler (1871) states that there were three stables of this design to his knowledge, it is not stated where these were located. One example may have been at Garth, Powys built for Richard Mytton, referred to be Worsley (2004). An alternative covered ride is described as being easily located between two rows of stables, with a roof over, providing a minimal size of one hundred by sixteen feet.

The Victorian era saw a variety of literature concerning the intricacies of stable design including William Haycock's (1869) Gentleman's Stable Manual concerning stable design and health. Underground stables are described in some detail, Wheeler (1871) describing their use as very objectionable, though unavoidable at times, but that they were tolerable provided that there was a good (though unspecified) floor to ceiling height and that cleanliness was maintained. The use of all porous materials were rejected, and the provision of an air shaft encouraged to maintain a flow of fresh air, which could be assisted by the constant use of a burning jet of gas at the top of the shaft.

Instructions for the location and fittings of the saddle harness room are detailed, describing the facility as a dry room, located next to the coach house and not the stables thus having less moisture and effluvia. The floor is recommended as being brick cement, with a stone and/or tiled floor, whereas the carriage house floor should be wooden, with hardwood trams for the wheels set a quarter of an inch below the surface (Wheeler, 1871).

Coleman (1897) provides a very detailed book on all aspects of stable design, construction and fixtures and fittings. He initially states exactly that he interprets a "stable" to be every description of building designed for the lodgement of animals in a state of domesticity, though it is generally understood that a stable refers to horses (and similar) only. It is stated that stables can be divided into five clear classes, which are described individually below:

1 Stables for racing, hunting, carriage and saddle horses of country and town mansions. These being designed and fitted regardless of the expense incurred, providing convenience though not necessarily the healthiest environment for the horse.

2 Stables of town and country residences of moderate fortune, fitted similarly to the above, being of a good and serviceable standard.

3 Stables to accommodate high numbers of horses, for example army, omnibus, tramway, business and carrier horses. Economics of construction, and maintenance of the facility being of paramount importance. It being considered that these horses were of a hardier and robust nature, thus ventilation and other provision could be much simplified.

4 Livery and Hackney stables were considered to be the cheapest of construction, with health of the occupants being an unimportant factor, with all fittings being minimal and low cost.

5 Farm stables were considered the cheapest to erect, with structure and fittings being primitive, mainly of wood, with inadequate drainage, hit and miss ventilation and windows (if any) of a haphazard fashion.

Brock (1937) states that nowadays it is exceptional for stabling to be built with a house, but for stables to be built separately, or improved by the owners design, and that it is possible to build "tolerable" stabling at a low cost, by either buying or erecting wooden stabling, or by converting an existing building. Table 2.6. details suitable stabling requirement as described by Brock (1937).

Table 2.6. Suitable Stabling Requirements

To provide a dry shelter.
Cold is not a problem, as clothing can be added.
South facing is preferable to ensure maximum light and sunlight.
Sanitation – the best drain is non-existent. Internal drains being troublesome, the ideal being an open channel through the centre of the stable, with a slight fall to a surface drain outside, all requiring to be washed regularly.
Concrete floors cold and slippery, Grit setts preferred.
Looseboxes preferred over stalls as movement of the horse is increased, though there is increased use of bedding in looseboxes. The minimum loosebox size being 12 X 10 feet, with a ½ door opening outwards and a frosted glass window with bars on the wall opposite the door, with the top half of the window being either fully open or removed completely. Additional louvre boards under the ridge allowing foul air removal.
A porcelain bowl/basin manger in the corner. The fact that is not the horses natural feeding positioned is referred to, in that though feeding on the floor is the horses natural way of feeding, this has to be questioned as the stabled horse is not living in a natural state. Also, feeding on the floor would increase the problem of droppings contaminating the feed bowl. Hay racks are not popular, but hay should be fed in a net attached to an iron ring in the wall four to five feet tall. Automatic watering systems are described as being scientific and expensive, and that water should be provided in a large galvanized bucket in the corner of the stable.
Electric lights should utilise a 100 watt bulb as 40 watt bulbs are a false economy.
Bins and barrels to be utilised as a forage store to deter vermin.
Manure pits to be in the corner of the garden, and constructed on a concrete platform with three, three feet high walls to contain it, with a slope to a drain on the open side.

(Brock, 1937)

Alternatively, the cost of keeping a horse at livery is described as £2.10s to £3.10s per week, whereas employment of staff would be as follows – one groom to look after three hunters or three polo ponies, plus the owners "kit" would require a wage of £2.10s per week, including a cottage, or £3 per week without a cottage. The groom would also require annually a stable suit, and a replacement Macintosh as required (Goldschmidt, 1928).

Authors have a specialist area within which they work, such as Worsley (2004) describing ornate stabling and Minahan (1999) focusing on the racing stables of Newmarket, proving detail within their own specialist area; Worsley (2004) concentrating on artistic architecture and Minahan (1999) utilising personal drawings

and paintings to illustrate the words produced. Further authors do contribute towards learning regarding the design features of stabling, but fail to clarify or question why such “ideal” statements and recommendations were made, or if the suggested practices are actually of good quality with regard to the design, and actual equine welfare.

Limited historic literature exists relating to social structure, health and management of the horse, but literature of a relatively modern nature is available concerning and relating to historic design, providing an historic reflection on practices. Poor design and construction is commented on in terms of disease prevalence, poor design implications and also poor knowledge of the horse keepers and managers concerned. The increase in practices for stables to be built as a separate entity to a house project or as a sectional “flat pack” design is commented on, as well as details of historic stable furnishings and expected design features, such as mangers and flooring materials. The evolution of the stable and stable yard leads into the design of the modern stable and stable yard, and what exactly is considered to be appropriate and necessary design criteria.

3.2. The Design and Construction of the Modern Stable and Stable Yard

To enable the design of the modern stable and stable yard to be evaluated fully, it is essential to evaluate a variety of areas individually, and to take into account the statement of Powell and Jackson (1992) that housing for horses evolved for the comfort and benefit of human handlers without considering horse welfare.

Warth (1997) describes the current stable as being four walls and a roof, with there being no sense in over-elaborating the building, it simply providing: dryness; warmth; fresh air; being draught free; hygienic and safe, with good natural light, the use of the horse being relevant to the standard of the provision. Dryness is maintained by the building being waterproof, with a roof overhang and removal of all damp bedding. Warmth is generally generated by the horse’s body heat, with ceiling insulation reducing condensation. Fresh air is provided by inlets and outlets, with little necessity for mechanical extraction methods. For both hygiene and safety reasons the floor is required to be free from hollows, and the stable having no other protrusions. Natural daylight is described as being necessary for well being, and also for growth and hormonal balance, the provision being assisted by facing the stable

towards the sun, usually in the Southerly direction (assuming in the Northern Hemisphere).

Gray (2001) states that:

> *"Modern thinking on stabling takes a different view to that of our ancestors, but there is no scientific evidence to support this. Ancestors benefited from generations of dependence on, and close living with the horse, and we should only discount their opinions on basis of positive research. Horses are best kept in individual stables with no cross communication divisions, peep holes or vents. 10 –18 °C is the optimum temperature for disease resistance. Eliminating draughts is imperative. Insulation is necessary. Ventilation requirements depend on weather conditions, temperature, building characteristics, stall size etc."*

3.2.1 Stable Locations

Requirements for location differ depending on the use of the stables/yard. The ideal site for any stable/stable block does not exist (Houghton-Brown and Powell Smith, 1989 and Pony Club, 1988), but a synthesis of the historical development indicates that a suitable site must be level, and well drained, with areas of concrete (or hard standing) used to assist with drainage. Protection from the North and Eastern prevailing winds is essential, though excessive use of trees and hedges should be avoided as air circulation can be reduced.

Trees are mentioned by Clarke (2000) in both a negative and a positive light, the negative being that trees in close proximity to stables causes problems with leaves blocking the drains, but trees may also provide a valuable wind break, especially at exposed sites. The stable(s) should be located downwind of the house (Houghton-Brown and Powell Smith, 1989), and vehicular, pedestrian and horse access considered allowing for routine and emergency use.

It is suggested that south facing stables are preferable to allow all year round open top door ventilation, and that an overhang or veranda can prevent the ingress of rain and severe weather (Pony Club, 1988). Ideally stables facing just east of south are suggested as ideal as they benefit from the morning sun, and that where rows of stables are required, designing them in a staggered way will ensure that all the stables can benefit. Clarke (2000) suggests that stables should not be positioned

near to a dust source such as hay barns or grain dryers. Private owners prefer stables, with storage facilities for feed, hay and bedding, plus a secure tack room. Commercial yards will also require a rest room/lounge for staff, tool stores and a muck bunker (Houghton-Brown and Powell Smith, 1989).

3.2.2 Stable Dimensions

Canning (1991) states that the modern dimensions for a hunters stable should be a minimum of 12 x 14 feet (3.6 x 4.2 m), with a pony stable being 12 x 12 feet (3.6 x 3.6m). Horse and Rider (2009) state that the minimum stable size must be 12 x 12 feet (3.6 x 3.6m), and larger for a big horse, but do not specify what is considered to be "larger" or a "big" horse. Head room must be "adequate" but is not specified. Houghton-Brown and Powell Smith (1989) state that a minimum of 42m^3 is required per horse/stable. Thus illustrating a huge discrepancy in suggested standards.

Powell and Jackson (1992) consider the minimum requirements to be smaller than Canning (1991) and Horse and Rider (2009), 10 x 10 feet (3.0 x 3.0m) being a minimum, 10 x 12 feet (3.0 x 3.6m) preferable, and 12 x 12 feet (3.6 x 3.6m) for a foaling stable. Draper (2002) has differing specifications for stable sizes, stating that 8 x 8 feet (2.4 x 2.2m) is adequate for a small pony, 10 x 12 feet (3.0 x 3.6m) for a 14hh pony, and 12 x 12 feet (3.6 x 3.6m) for a horse.

Crichlow *et. al. (*1980) suggests that isolation stables are required to be 16 x 16 feet (5.0 x 5.0m) in size, presumably because when the horse is isolated very limited exercise is available, and thus a larger than average stable is preferable. A pony stable is described as 10 x 10 feet (3.0 x 3.0m) and a horse stable as 12 x 12 feet (3.6 x 3.6m).

The Pony Club (1988) consider that stables are the most satisfactory stable accommodation (above stalls) as the horse has freedom of movement, is encouraged to lie down and rest and is therefore more comfortable than in a stall. Stalls do however allow for a large number of horses to be kept in a small space, are less labour intensive and reduce bedding usage. Though the disadvantages include (Pony Club, 1988) reduced movement for the horse, boredom as reduced ability to look out, and the possibility of no direct access to fresh air or sunlight depending on the layout of the stalls. Bullying can occur if the dividing partitions are not high enough.

Draper (2002) describes stables as being the most popular method of housing horses, with American barns being unsuitable as they have a high disease risk and poor ventilation, and the use of communal yards being unpopular in the UK, though as the horses are grouped together they have adequate company, and it is a labour saving method of management. It is also stated (Draper, 2002) that "living indoors is not natural for horses so it is up to the owner to ensure that the effects are not detrimental"

3.2.3 Building Materials

Houghton Brown and Powell Smith (1989) state that sound stables are a good investment, they do not need to be grand, but it is preferable if they are purpose built as this will add value to the property, especially if brick is utilised in preference to timber, which is commonly used in private situations. Horse and Rider (2009) recommend that any building used to house horses must be structurally sound, as horses are strong animals, and if used as housing for other stock previously should be disinfected prior to equine use to prevent contagious diseases spreading.

Canning (1991) recommended that brick built stables are preferable to timber stables as they are stronger, and provide a greater degree of insulation provided that they are constructed of double skin walls, not a single skin, and that this also deters rodents. Timber stables may be cheaper to construct, but result in a greater fire risk than brick/stone stables. Parker (2009) states that gaining planning permission for timber stables may be easier to obtain than for brick or block stables, due to the fact that they are seen as being a less permanent structure. Though it is stated that though timber stables are quick and easy to construct and assemble, and are forgiving on the legs if kicked, they are easily damaged and require a certain level of maintenance to remain in good condition, as well as being of a greater fire risk, but the ultimate choice must be made with regard to budget and maintenance.

Canning (1991) stresses that free drainage is of prime importance to prevent the horse becoming damp and cold, and that flooring can be constructed from a variety of materials, with varying degrees of success; stable bricks producing a good quality flooring, but being expensive to purchase; cobbles being unsatisfactory as being uneven; stone slabs being unsatisfactory as they may either crack or wear smooth and becoming slippery with use; tarmac being slippery; clay requiring annual replacement and laying; concrete being acceptable provided a damp-proof course is

utilised throughout and that a roughened surface is created, it is also considered to be an economical option. Horse and Rider (2009) also mentions the need to take into account adequate drainage for rainwater, and the usefulness of electric sockets close to the stable.

Draper (2002) describes good building materials as being brick, breezeblock or wood, but corrugated iron as unsuitable as both a wall and a roofing material. The roof should be slate, tile, felt covered wood, or heavy duty corrugated plastic, but metal sheeting should be avoided. Houghton-Brown and Powell Smith (1989) describe galvanized iron as inappropriate for a roofing material as it is cold and causes condensation in winter, and is hot in summer.

3.2.4 Ventilation

Ventilation is considered essential for the well being of the stabled horse, with the air changed frequently, without drafts. Windows should be of the "Sheringham" design - hinged at the lower edge and open with an inwards slant, and covered by wire mesh to prevent the horse gaining direct access to them. The Sheringham design not causing a draft at the level of the horse, but allows for cold air to circulate upwards and mix with warm air above the horse, louvre boards under the edge of the roof increase airflow further and produces an outlet for stale air (Canning, 1991, and Houghton-Brown and Powell Smith, 1989).

Air control within a building is governed to a large degree by a number of regulations; building regulations, workplace regulations, Housing Acts and Health and Safety at Work legislation. The general measurement being based around human occupation of a building with 1.5 air changes required per hour, equating to approximately 8 litres per second per person/occupant. Air control and ventilation is calculated using the area of windows which is available, the actual opening area, the use of a fan and also the stack effect throughout the building (McMullen, 2007).

McMullen (2007) discusses humidity at length, alongside condensation, including the definition of Saturated Vapour Pressure (SVP) and Dew Point, the point where surface condensation occurs at a given temperature. Remedies to condensation are stated (McMullen, 2007) as including ventilation, heating and insulation. Vapour transfer properties of building materials (water movement from inside to outside a property through a given material) are stated against water resistivity. The following

list is in order of resistivity, with high resistivity at the top of the list: concrete; hardboard; plywood; timber; stone (McMullen, 2007).

Horse and Rider (2009) state that plenty of clean air is essential to prevent illness, but too draughty an environment will be cold. Houghton-Brown and Powell Smith (1989) states that the ideal temperature for a stabled horse is below 15 °C. The ideal temperature required as described by Beeton (2000) differs from that of 50 – 55° F (10 – 13° C) stated by Barton (1920). Beeton (2000) stating that the stable temperature should be 55° F (10° C) in the winter and 60° F (15.5° C) in the Summer, and that some grooms insist that a higher temperature is required, in the interests of their own labour. Temperature regulation by ventilation includes the use of one or more tubes or boxes of wood or iron through the ceiling or the roof, with a sloping covering to keep out the rain, with valves and ventilators below to regulate the atmosphere. There should be an opening in the wall to admit fresh air, and with hollow walls, a grating at the bottom outside to exit air, fresh air drawn in from above, thus enabling heating of the air before entering the stable.

The Pony Club (1988) state simply that the best way to ventilate a stable is to leave the top door open at all times, and that it is preferable to use an extra rug in cold weather than to close the door and restrict the air flow. A window on the same wall as the door reducing draughts across the horses back. Powell and Jackson (1992) discuss ventilation in greater detail than the authors referenced above. It is stated (Powell and Jackson, 1992) that low temperatures (not specified) and humidity above 70% is detrimental to the horses health. Air movement is required at 30 - 100 cubic feet (0.84 – 2.83m^3) per minute, a ventilation rate of 6-30 litres per minute per kg of bodyweight. This is averaged at a minimum of eight complete air changes within the stable per hour.

O'Brien (2007) states that most stables are poorly ventilated, especially those with low roofs and no other air inlet than the stable door. It is suggested that to increase ventilation, holes approximately two inches in diameter can be drilled along the top of the back wall of the stable – but the distance between the holes is not discussed. Ideally (O'Brien, 2007) each stable would have a small yard in front of the stable allowing the horse to wander around. Yorkshire or spaced boarding is stated (O'Brien, 2007) as an excellent way to provide free ventilation, provided that the gaps are an identical size to the thickness of the board. In addition to quality ventilation within the stable, a good quality clean air regime can be implemented by regular

removal of all dust and cobwebs, and ensuring that all stables are managed in an identical manner.

Ventilation is described by Warth (1997) in much greater detail than in other literature, the various methods of ventilation being –

1 The Stack Effect: Warm air rising inducing air movement.

2 Aspiration: Wind outside the stable passing over the building and "sucking" air from the stable.

3 Wind Effect: Wind directly entering and leaving the stable.

The optimal number of air changes within the stable is three to ten per hour. Below three producing stale air, above ten producing a chilly environment.

It can be calculated that an "average" 12 x 12 feet (3.65 x 3.65m) stable, with a height of 11 feet (3.35m) = 43 cubic meters (m^3) of air volume.

Ventilation removes moisture, pathogens, oxygen, heat, ammonia and dust. Natural ventilation is referred to as ACH (air change per hour) with the ideal being four to eight ACH, with six ACH equating to one change every ten minutes. Wheeler (2006) does further state that accurate measurement of the ventilation rate is nearly impossible, and that factors such as temperature, and wind speed must be taken into consideration (Wheeler, 2006). It is stated that in the American barn the ventilation criteria is not so essential/critical due to the increased air volume which is available, though Sainsbury and Rossdale (1987) state that American barns always have below the required ventilation rate and that the minimal recommended number of air changes is seldom achieved.

Mathews and Arndt (2003) describe the environmental control of stabling as an important aspect to health, stressing that poor building design negatively effects health in the form of environmental disease due to unacceptable levels of respiratory pathogens and allergens being present, and also reducing performance in the competition horse. It is stated (Mathews and Arndt, 2003) that natural ventilation can be utilised to provide acceptable ventilation standards, but that it is difficult to design a stable which meets the criteria of natural ventilation levels which also provides acceptable comfort levels.

Mathews and Arndt (2003) undertook thermal and ventilation modelling: concluding that the best ventilation method within the stable was the stack effect; temperature induced ventilation. It was also concluded (Mathews and Arndt, 2003) that in the ideal situation vertical ventilation openings should be placed one above the other for greatest effect.

3.2.5 Flooring

Chapelstone (2009) states that a properly constructed base must be used, to include the correct “fall” (gradient) for liquid runoff, use engineering bricks for the sighting of wooden stabling, and the correct concrete (fibre reinforced concrete) designed for agricultural and equine use, which is resistant to urine and therefore longer lasting that usual builders concrete. Quattro (2009) describes the use of bespoke rubber stable matting to provide the required level of protection from the underlying hard flooring surface. Mats being bonded or sealed to provide a layered floor surface, with the surface of the mats having a roughened or dot prolife to provide grip.

Little has been written regarding flooring colour. Hall and Cassaday (2006) studied horses reactions to coloured floor mats utilised both on the floor and secured to a wall. No reaction was noted when the horse walked past the mats fastened to the wall, but a reaction was noted when the mats were positioned on the floor and the horse was required to walk over them. The results suggest that the horse may be dichromatic, seeing a limited colour range rather than distinctive colours. The yellow, white, black and blue mats produced a greater reaction than green, red, brown and grey mats. It was concluded that this was because the colours which did not produce a great reaction were naturally occurring colours and the horse was commonly used to seeing and walking on these colours, whereas yellow, white, black and blue floor surfaces were not naturally encountered (Hall and Cassaday, 2006). This research raises questions concerning the common usage of black mats as stable flooring and also on trailer and lorry ramps, and may indicate why horses may not wish to load into a trailer or lorry, not because they are resistant to actually going into the vehicle but that they are resistant to tread onto the black matting (Hall and Cassaday, 2006).

3.2.6 Fixtures and Fittings

Stable doors should be a minimum of 8 feet (2.43m) high and 4 feet (1.21m) wide (Canning, 1991) allowing adequate head and shoulder/hind quarters room for entering and leaving the stable, and should open outwards at all times, thus

preventing a sick or injured horse (or handler) from becoming trapped inside the stable. The base of the lower door being secured by a foot-operated bolt to prevent the groom constantly having to bend to open and shut it (Canning, 1991).

Fixtures and fittings are stated (Canning, 1991) to be kept to a minimum to reduce the risk of injury, the minimum required being: a ring for tying up; a haynet ring; a water supply; and horse-proof electric light switches outside the stable. Canning (1991) does state that an automatic water supply is essential, and does not take into account that this is not readily available or practical to install in many situations.

McMullen (2007) describes lighting as being the luminous intensity (LI), the power of the lighting source or the illuminated surface. Discomfort glare is also described, being the point at which visual discomfort is caused, for example by a bare light bulb. The point where visual glare occurs applies to the human eye, rather than the horse's eye, but it is surmised that discomfort occurs for the horse at a similar level.

The Pony Club (1988) suggest that mangers, hay racks and permanent water bowls should be dispensed with, and the horse fed and watered from ground level which is more natural. Haynets and racks were condemned (Pony Club, 1988) as set at an unnatural feeding height and allowing dust and hayseeds to fall into the horses eyes. An alternative suggestion (Pony Club, 1988) to a high haynet ring was to tie the haynet from the short-rack (tying ring) at 1.5m high. This does not take into account the danger of a horse getting a leg into the net and becoming injured.

Lilley (2007) states that water buckets can be inserted into a tyre to reduce the chance of it being kicked over and spilt, flooding the bed. Automatic drinkers reduce labour, but must still be wiped clean daily especially where the horse enjoys dunking its hay in the drinker. Draper (2002) emphases the hygiene aspects of water supply by stating that water buckets or automatic waterers are suitable, provided they have a plug so that they can be cleaned regularly. All external drains should have strong covers (Draper, 2002).

McMullen (2007) touches on waste water, a topic often not mentioned in texts concerning stable design. It is described that a drain is a below ground pipe, or a closed channel with a flow which is influenced by gravity. Soil water is specifically water from a WC, foul water being a mixture of soil water and other waste water (for instance from a bath/shower or wash basin) and surface/storm water being clean water from a roof or paved surface.

3.2.7 Allied Requirements

The Pony Club (1988) includes aspects of muckheaps stating that "*to judge a man's stable management, visit the manure heap*". The heap requiring regular emptying, and should be stacked into three areas – an old heap, a near old heap and a current heap.

3.2.8 Fire and Disaster Management

With regard to fire it is stated that fire detection systems are relatively common to be fitted into new yards at the construction stage. A fire wall reaching to the roof of every fourth stable is required to slow the force of a fire should it occur, thus containing it temporarily. A water stand pipe should be available for every twenty horses, with a long enough hose reel to reach the required area. Water/gas extinguishers should be provided at an adequate level, along with adequate dry powder/CO2 extinguishers where electrical equipment is stored and or installed. In the USA it is relatively common for sprinkler systems to be utilised within the stable yard, but this is not commonly seen within the UK at present (Warth, 1997).

Swinker (2000) writes at length concerning the risk of fire within the stable yard, how to reduce the risk and managing an incident should it occur. It is stated that should a fire occur the horse within that particular stable has only thirty seconds to be rescued due to the speed and heat of a fire, thus allowing an extremely short amount of time for evacuation to occur. The speed at which fire takes hold of a stable is attenuated by the buildings internal and external structure, as well as bedding, forage, rugs, clothing and equipment, and also that a well ventilated stable effectively ventilates a fire, thus increasing the spread of the fire. It is stated (Swinker, 2000) that every stall/stable should have an external door to allow for ease of evacuation, though this is a rare occurrence.

Clear fire prevention signage needs to be displayed, such as no smoking signs and a clear evacuation procedure which is regularly practiced, showing the location of fire alarms, emergency telephone numbers and the telephone, and the location of fire extinguishers (Swinker, 2000). It is suggested (Swinker, 2000) that halters and lead ropes are hung on the outside of each stable door for ease and speed of horse evacuation (Swinker, 2000).

The practicalities of management of a disaster situation are covered by Heath (1995) and though not strictly related to stable design, are prudent to the stable designer to highlight the “what if” situations which may occur and how they need to be prepared for adequately.

3.2.9 Current Design

Scotts of Thrapston (2009) established in 1920 quote themselves as “The Masters” in stabling, specialising in timber equestrian buildings from conception, through design and construction, to the finished product. They state (Scotts, 2009) their designs take into account the practical and lifestyle requirements of the proposed stabling and pay attention to detail. A number of specific yards needs are stated (Scotts, 2009) – the private yard necessitating being well designed and practical, with thought given to the muck heap location, hay store access and storage solutions. The professional yard having to be designed as an effective and practical working environment and also catering for the horses needs, with maximum business benefit and essential features such as larger stables, sufficient ventilation, additional headroom, internal grilles, veterinary boxes, larger feed rooms, staff rest rooms and offices. Commercial yards require the maximum number of stables in the space provided, an ‘E’ design being successful for both customers and staff. The commercial yard requiring the addition of a reception area, disabled access, changing facilities, a larger tack room, wash down areas, and easy access for feed and bedding stores.

It is stated (Scotts, 2009) that dressage yards require the highest level of perfection and ensure working life is as easy as possible. The design usually includes large tack rooms, wash down areas, extended overhangs and being in a popular ‘L’ or ‘U’ shape. The polo yard is designed to ensure for “happy” polo ponies, with lower stable doors, usually excluding the top door, oak posts and an extended overhang. Carriage driving yards require more space than the usual riding horse yard, with wider access requirements and an integral carriage house, plus covered walk ways for harnessing and “putting to” (Scotts, 2009).

Common yard layouts are described (Scotts, 2009) as being ‘L’, ‘U’ or ‘E’ shaped or a straight line, each having advantages and disadvantages. The ‘L’ shaped yard being popular, convenient, attractive and suited to a corner location; ensuring ease of access to all stables and effective shelter. The ‘U’ shaped yard being suited for the

larger development where a larger working area is required. The 'U' shape yard provides ease of management for horses and for staff, and an increased level of shelter. The 'E' shaped yard being popular for commercial establishments where stabling and offices/workshops are integrated. The 'E' shape providing two distinct areas, whilst being connected and containing shared facilities. The straight line yard design being of benefit where space is of a premium and usually for the smaller or private yard, but also for the larger yard where a degree of segregation is required (Scotts, 2009).

The Stable Company (2009a) described these layouts in more detail than Scotts (2009) stating that 'The Straight' is usually associated with smaller schemes, with the straight run of stables being the simplest form of design. The 'L' shape is described (The Stable Company, 2009a) as working well in the corner of a field or paddock, with the rear of the design to the prevailing wind, and is the most popular design offering a compact, sheltered and easy to work in yard. The 'U' shape offers greater protection and flexibility, expanding on the popular 'L' shape to produce an enclosed yard, often with a feature archway or a covered entrance.

Scotts (2009) utilise European redwood tongue and groove shiplap boarding, over a timber frame. Stain or paint finish is applied prior to construction to ensure complete timber coverage, with a final coat applied post construction.

Roof construction includes (Scotts, 2009) a 25˚ pitch roof, with 1.2m overhang with evenly spaced ventilators for cross ventilation. At eaves level, at the rear, are additional vents to ensure adequate air movement (Scotts, 2009). The Stable Company (2009a) offer flexibility regarding stable design; roof cladding type determining the roof structure; one or two courses of brickwork used to increase eaves height; customised overhang. Roof pitches of 20˚ being the standard pitch (The Stable Company, 2009a) but 20˚, 25˚ or 30˚ available; cladding is featheredge or shiplap.

Scotts (2009) stables have internal kicking boards to eaves height in exterior grade board. These are moisture resistant and fitted with additional timbers behind them to improve longevity, in addition "Stockboard" can be utilised for the particularly boisterous horse, providing additional protection to the stable. The boards can be steam cleaned, and also painted in the traditional manner.

Roof timbers may be lined underneath (Scotts, 2009) to provide a dust free environment. Where weather conditions or specialist requirements dictate, insulation can be installed to both the walls and the roof area.

Scotts (2009) stable doors and frames are referred to as “Newmarket”, but follow the traditional half door pattern, the doors being manufactured from tongue and groove pressure treated boarding with heavy duty galvanized steel lining, and a deep capping to reduce chewing. The frames are pressure treated and fully encased with galvanised steel for additional protection. Rear upper doors are quoted (Scotts, 2009) as “*proving a popular additional option for many customers, offering the horses an all round view, whilst improving the circulation of fresh air*”. The use of these is dependent on the design and location of the yard.

Ventilation and light are provided in each stable by a standard louvred, Perspex window, with a galvanized steel frame; a galvanized internal grille providing maximum security without impinging on ventilation (Scotts, 2009).

Fixtures and fittings are available (Scotts, 2009) with mangers and tie rings provided in each stable as standard, and additional internal grilles for partitioning, anti-weave grills, boxed-in mangers, hay racks, feed bins, anti-cast rails, automatic drinkers, rubber matting and hay bars all available to suit specific requirements.

The American Barn is quoted as being increasingly popular (Scotts, 2009) as the barn offers the provision for everything to be in one place, arranged around a central passageway and providing shelter from the weather for horses and staff. Standard features are incorporated to contribute to the welfare of the horse, such as rear louvred windows with grilles to provide light and ventilation, ventilation ridges being utilised to increase ventilation rates. Profiled metal sheeting is used for the roof, which can be insulated and lined. Sliding doors at one or both ends of the building provide easy access, and are large enough to accommodate a tractor. Internally, the stalls within the American Barn (Scotts, 2009) are lined with kick boarding to eaves height, and can have galvanised grilles with hardwood panels to both the front and dividing partitions. Each stable has a plastic corner manger fitted as standard.

National (2009) provides three ranges of timber stabling; the National being the standard range, the Grand National being manufactured to a higher standard, including a unique door design, with a galvanised steel frame and adjustable hinges, and the option of a newly introduced sliding door. The Cheltenham Gold is the

highest standard, with an increased eaves height of 2500 mm; the roof having a ridge ventilator and the canopy lined with exterior grade ply.

Chapelstone (2009) specialise in providing bespoke stabling to be used in existing buildings. Wall panels have an eaves height of 2300 mm when on a brick course, with 125 X 16 mm external Shiplap weatherboard cladding, softwood framework and softwood kickboards to 1219 mm (four feet) high. Stable doors are seasoned tongue and groove board, framed, ledged and braced and lined on the inside with ply, galvanised chew strips are used, as are kick over bolts.

Windows are clear Perspex with protective bars; Onduline corrugated roof sheeting is used with galvanised ridge cappings to aid ventilation; brown plastic rainwater goods are installed to the front of the building, and can be installed to the rear if required. All buildings are treated with chestnut brown preservative to the inside and the outside upon completion (Chapelstone, 2009).

Redmire (2009) produce a number of ranges; the Goodwood range designed to complement houses and property with higher pitched roofing; the Hunter range being long established; the Haven range designed as a starter stable, being straightforward in design, uncomplicated, but built to last.

Hancox (2009) describe stabling starting from an empty space, extending an existing layout or replacing out of date stabling and equipment. A range of choices are available (Hancox, 2009); the Epsom range providing a standard value for money specification; the Windsor range having an open appearance, using curved grills on either side of a central door and keeper posts with bronze, brass or aluminium caps; the Victorian range emulates the period, with round posts, brass finials and arched doorways. There is also a patented spring loaded handle which can be used from either inside or outside the stable.

There is an extensive range of accessories (Hancox, 2009); water drinkers; swivel mangers; low level hay racks (not a traditional rack, but a solid bar/barrier to be used in the corner of the stable starting at floor level; horizontal rug racks for outside the stable and vertical rug rails for use where a number of rugs require hanging for storage or drying purposes.

Purpose designed and built polo pony stable is described by Fitzgerald *et. al.* (1997). The yard was designed to house forty nine polo ponies during the summer only as

polo ponies are turned out at grass at the end of the polo season, allied facilities and accommodation for a polo manager, two polo players and a senior groom in four self contained units. The design was in a courtyard fashion, and designed to fit in with existing buildings dating back to the 1750's, plus to be compliant with planning within an Area of Outstanding Natural Beauty. The buildings were constructed out of blockwork with outer skins of knapped flint, edged with handmade bricks and handmade clay tiles on the roof. Internal fittings and fixtures included built in troughs with curved edges, recessed fittings, metal framed doors and efficient natural ventilation.

Though much has been written concerning modern ideas on the design and construction of stables and stable yards, the work concerning the design in relation to the horses social structure, health and management varies greatly in detail and volume of information.

Yard tips from the pro's (Spicer, 2010) provides an insight into the professional riders experiences and requirements concerning stable design and construction, and allied facilities which are necessary within a professional establishment. An example of a professional yard is described as being a purpose built establishment of twenty stables, all under one roof to avoid the inconvenience of poor weather, with each stable having an external window which can be looked out of. The roof is insulated which was stated as being expensive, but this along with cavity wall insulation maintains the stable block cool in summer and warm in winter. The building was designed to maximise ventilation and light, having a 7.5 meter high to ridge roof to allow maximum air circulation and also a 1.5 meter roof ridge light to maximise natural light.

Within this yard specific saddling bays are utilised next to the tack rooms to allow the horse to be secured close to the tack storage area, rather than the tack having to be taken a distance across the yard to the horse. The tack room also has a finger print recognition locking system, allowing those registered easy access without the need for keys. There were also specific wash down boxes with Italian black tiles, a solarium sourced from Germany and a rider area with kitchen, toilets and showers (Spicer, 2010).

Spicer (2010) provides a number of quotes from professional riders, with a range of ideas, from both the human and the horse perspective. Emily Llewellyn (event rider)

states that she uses rubber floor matting part way up the walls of the stables to prevent the horses getting cast. She suggests that stables should be designed taking into account the yard logistics, and how the yard fits together. Laura Bechtolsheimer (dressage rider) describes that it is vital to look at everything from the horses point of view, not just the human perspective, and that what looks nice may not actually be practical (Spicer, 2010). Jay Hamlin (event rider) shares a yard with dressage rider Spenser Wilton. He comments that it is important to have as much of the yard as possible under cover but to ensure that as much ventilation as possible is incorporated (Spicer, 2010).

3.2.10. Summary

Modern design and construction is described within a number of key professional texts, including those of Houghton Brown and Powell Smith (1989), the Pony Club (1988) and Canning (1991). Key headings include: building materials; ventilation; flooring; fixtures and fittings; along with allied requirements including: yard design; the pattern with which the stables are designed and built.

These and other key texts of a similar date demonstrate the development of professional equine literature during the late 1980's and early 1990's driven by the upsurge in academic equine courses and have been little updated since as there has been a perception that there has been no need to update and no new studies have been undertaken.

Throughout the literature; best practice is stated, but best practice is not generally related to factual reasoning(s) for selection or actual criteria specifications. Stabling companies who provide sectional stabling state exactly what can be provided, but provide little reasoning(s) for why designs are utilised. There appears to be only one study relating to the actual investigation and interpretation of stable yards relating specifically to racehorse stabling within the South West of England, (Jones *et., al.* 1987) thus being both geographically and equine sector restrictive (racing industry), but nevertheless providing a unique investigation into the stabling provision provided.

Stable design is generally considered (McBane, 1992. and Kiley-Worthington, 1997.) as being utilised for human convenience and to enable the modern use of the horse; thus allowing the horse to be kept fit for leisure or competition use, clipped and groomed and convenient for the owner/manager in terms of location and ease of access. A poignant comment regarding stable design is from a young British

dressage rider whom stated that stable and stable yard design should be looked at from the horses point of view and not from the human perspective, and that what is considered aesthetically pleasing may not actually be practical for the horse. Modern stable design criteria appears to be based upon little foundation research, and not specifically related to whether the stables are actually fit for purpose for the modern Equidae.

3.3. Fitness for Purpose

As in previous chapters, a variety of horses are included with regard to Fitness for Purpose, including riding horses, and commercial horses incorporating police and military horses. Current welfare legislation is reviewed to reflect the minimal specifications regarding stable provision.

3.3.1. Equine Welfare Legislation

Equine welfare legislation currently relates to The Animal Welfare Act 2006. This act is primarily operated through animal specific Codes of Practice. Though it is not an offence to fail to comply with the applicable Code of Practice, none compliance with the appropriate Code may be utilised in the event of welfare intervention or investigation (DEFRA, 2006). Within England the applicable Code is detailed as the Code of Practice for the Welfare of Horses, Ponies, Donkeys and their Hybrids DEFRA (2006). Within Scotland the Codes of Practice for the Welfare of Animals Equidae is the relevant document (The Scottish Government, 2009). Within Wales the Code of Practice for the Welfare of Equines is the relevant document (Welsh Assembly Government, 2008) and in Northern Ireland the Code of Practice for the Welfare of Horses, Ponies, Donkeys and their Hybrids is the relevant document (Department of Agriculture and Rural Development, 2012).

The Animal Welfare Act 2006 is described as the first overhaul of animal welfare legislation since 1911 and is a collation of a number of legislative documents. The 2006 Act is the first act to include an offence relating to the duty of care for pet ownership, as previous legislation did not include pets or pet ownership responsibilities. The Act was developed via public consultation in 2002, and included the work of the RSPCA and numerous other animal welfare organisations. The Act, which although it does include domestic pets does not include: farm animals; laboratory animals; racing horses; or racing greyhounds, but does cover all non-racing horses.

The RSPCA (2012) stress that the 2006 Act with relevant Codes was vital to improve equine welfare as during 2006 the incidence of horse and pony welfare concerns increased by 33%, the largest of any animal group within that time period.

The Animal Welfare Act (2006) has developed from historical animal welfare legislation dating from the 1820's, and follows the time line illustrated below.

Cruelty to Animals Act 1849:– which consolidates the Cruelty to Cattle Act 1822 and the Cruelty to Animals Act 1835; (also known as Martin's Act)
Cruelty to Animals Act 1876;
Protection of Animals Act 1911;
Protection of Animals Act (Amended) 1954;
The Animal Welfare Act 2006.

Figure 3.3. Animal Welfare Legislation Time Line (DEFRA, (2006).

The Cruelty to Animals Act 1849 made it an offence to beat, ill treat, over drive, abuse or torture animals with a maximum penalty of £5 and compensation of up to £10.

The Cruelty to Animals Act 1835 included cattle, bulls, dogs, bears and sheep. It prohibited bear bating and cock fighting. It included legislation to protect animals, created shelters and veterinary hospitals and also concerned humane transportation and slaughter, but had no wild animal provision, and no specific reference to horses.

The 1835 Act was also known as Martin's Act after Richard Martin, MP an animal rights campaigner. It was the first piece of animal welfare legislation within the UK, and was formulated shortly after the formation of the RSPCA in 1824, thus highlighting political and public concerns concerning animal welfare.

The 1876 Act regulated vivisection, and introduced a licensing and inspection system. This remained in force regarding animal experimentation regulation until 1986, when it was superseded by the Animals (Scientific Procedures) Act. The 1876 Act also made it an offence to cruelly beat, kick, ill-treat, over-drive, over-ride, overload, torture, infuriate or terrify any animal. This was the first legislation to encompass "all" animals.

The 1911 Act includes permitting any unnecessary suffering; conveying or carrying an animal in a manner or position to cause unnecessary suffering; fighting or baiting; administration of poisonous of injurious drugs or substances; any operation performed without due care and humanity; tether any horse, ass or mule under such

conditions or in such a manner to cause unnecessary suffering. This is the first time that specific tethering legislation is included, though only horses, ass and mules were included, not other Equidae. The 1911 Act was amended in 1954, to include the disqualification of any person convicted under the Act of having custody of any animal.

The Animal Welfare Act 2006 refers to the keeper of the horse being responsible for ensuring the horse:

i) Has a suitable environment to live in;
ii) Has a healthy diet;
iii) Is able to behave normally;
iv) Has appropriate company;
v) Is protected from pain, suffering, injury and disease.

(DEFRA, (2006).

Section 1 (DEFRA, 2006) specifies the Environmental details and requirements regarding: shelter; pasture; stable accommodation/housing; tethering; rugs; and supervision: thus relating to the minimum expected requirements for stabling. (Appendix 3)

3.3.2. Fitness for Purpose

DEFRA (2006) specifically details requirements concerning equine welfare, and is of specific relevance to this thesis with regard to ensuring the horse "*has a suitable environment to live in*", thus the stabling facility is fit for the purpose and does include both pasture and stabling accommodation requirements. Regarding the actual stabling requirements: construction; fixtures and fittings; floors; doors; roofs; light; windows; and ventilation slats; are all of specific interest, but the whole section concerning stable accommodation/housing is a vital benchmark to which a valid assessment of the stabling provision within England can be assessed against.

The legislative Fit for Purpose data described in DEFRA (2006) relates to the literature describing stabling and management of the horse within this thesis, but is the defining legislative document, thus providing definitive criteria and specification.

There is no mention of stalls within the Code, simply loose boxes, barns or stables. But it is stated that the minimum requirement for each horse is sufficient space to lie down, readily rise and to turn round in comfort. Stalls are expected to provide

sufficient space to allow the horse to lie down and rise readily, but will not provide adequate room for the horse to turn round, as this is not expected within the design of a stall, only within a stable. The Code described tethering as being when the horse is secured by a tether in an outdoor situation, such as on a common or grass/pasture area, but does also refer to horses which are "stall-tied" and specifically refers to stall-tying as being utilised by the cavalry. The Code describes the need for stall-tied horses to receive regular exercise, unless the contrary is required due to veterinary treatment.

3.3.3. Synthesis of Fitness for Purpose Criteria

Fitness for Purpose criteria is directly linked to the literature review as illustrated in Table 3.1.

Table 3.1. Synthesis of Fitness for Purpose Criteria

Item		**Source**
Construction	Materials	Canning (1991); Draper (2002); Houghton-Brown and Powell Smith (1989)
Fixtures and Fittings	Specification	Canning (1991); Draper (2002); Hinton (1978); Houghton-Brown and Powell Smith (1989); Lilley (2007); Peters (2003); The Pony Club (1988)
Floors	Materials	Chapelstone (2009); McBane (1992)
	Drainage	Canning (1991); McBane (1992); Worsley (2004): Warth (1997)
Doors	Specifications	Canning (1991); Scotts (2009)
Roofs	Structure	Draper (2002); Wheeler (2006)
Light	Specification	Scotts (2009); Worsley (2004)
Windows and Ventilation Slats	Ventilation	Canning (1991); Horse and Rider (2009); Houghton-Brown and Powell Smith (1989); Powell and Jackson (1992);
Size: Horse	Stable wall minimum length	Pederson *et. al.* (2004); Raabymagle and Ladewig (2006)
	Stable footprint/dimensions	Canning (1991); Draper (2002); Horse and Rider (2009); Houghton-Brown and Powell Smith (1989); Raabymagle and Ladewig (2006); Powell and Jackson (1992)
Size: Large Horse	Dimensions	Canning (1991); Horse and Rider (2009); Pederson *et. al.* (2004); Raabymagle and Ladewig (2006)

Social Interaction	Social and Physical Interaction	Borsheim et. al. (2008); Harewood and McGowan (2005); Horsetalk (2007); Nagy *et. al*. (2008); Specialequineresearch (2007)
	Behaviour	Kiley Worthington (1997); McGreevy *et. al*. (1995); Rose - Meierhöfer *et. al.* (2010); Sondergaard and Winther Christian (2006); Zeeb and Schnitzer (1997)
	Herd Structure	Berger (1977); Estes (1974); Kaseda and Khalil (1996); Klingel (1975); McDonnell *et. al.* (1995)
Free Exercise	Paddock provision	Jansson *et. al.* (2008); Werhahn *et. al.* (2011)

These Fitness for Purpose Criteria are utilised as the basis of the fieldwork analysis presented later in the thesis.

A number of authors have produced literature relevant to Chapter Three, but the majority of the literature is descriptive and factual, with little critical discussion or analysis of the positive, or negative aspects of the subject matter, or the relevance of historic design and construction to the requirements of the modern horse. This is especially evident and relevant with regard to stable size and stable design, where the literature is factual, with minimal reasoning concerning the reasoning for stable sizes, or design aspects.

The literature concerning design and construction of the modern stable and stable yard continues as does the historic based literature to be largely descriptive, including regarding the stabling manufacturers details and specifications, with limited discussion, evaluation and interpretation of the specific factors, both positive and negative concerning design and construction.

Contemporary research and literature concerning equine welfare, specifically DEFRA (2006) provided a basis for the development of the Fitness for Purpose criteria, including the main headings utilised within the Fitness for Purpose data analysis of the case study data, alongside allied literature as detailed in Table 3.1.

Table 3.2. Synthesis of Literature: The Stable

	Reference	Strength	Weakness
The evolution of stables and stable yards	Birch (1883), Clifford (1585), Da Vinci (1888), De Grey (1693), English Heritage (2006), Glendinning and Wade (2008), Greeves (1989), Gibson (1721), Harris (2005), Jenkins (2009), Markham (1607), Miles (1844), North (1581), Peters (2003), Powell (1991), Worsley (2004)	Historic stables/stabling literature	Descriptive and limited relation to modern stabling, or management of the horse
The design and construction of the modern stable and stable yard	Brock (1937), Canning (1991), Coleman (1897), Crichlow *et. al.* (1980), Da Vinci (1888), Draper (2002), Goldschmidt (1928), Gray (2001), Horse and Rider (2009), Houghton Brown and Powell Smith (1989), Parker (2009), Pony Club (1988), Clarke (2000), Powell and Jackson (1992), Warth (1997), Wheeler (1871),	Stable size, design and construction literature	Descriptive, limited experimental data

	Worsley (2004)		
	McMullen (2007)	Construction/ventilation data	Not directly related to stables
	Beeton (1920), Horse and Rider (2009), Houghton Brown and Powell Smith (1989), Mathews and Arndt (2003), O'Brien, Powell and Jackson, Sainsbury and Rossdale (1987), The Pony Club (1988), Warth (1997), Wheeler (2006),	Ventilation, air quality, temperature	Generally descriptive, limited experimental data
	Chapelstone (2009), Hall and Cassaday (2006), Quattro (2009),	Construction flooring	Generally descriptive, limited experimental data
	Canning (1991), Draper (2002), Lilley (2007), McMullen (2007), Swinker (2000), The Pony Club (1988), Warth (1997),	Construction fixtures and fittings, allied requirements, fire and disaster management	Generally descriptive, limited experimental data
	Chapelstone (2009), Hancox (2009), Fitzgerald *et. al.* (1997) National (2009), Redmire (2009), Scotts (2009), Spicer (2010), The Stable Company (2009a)	Contemporary stabling	Generally descriptive, limited experimental data

Fitness for purpose	Department of Agriculture and Rural Development (2012), DEFRA (2006), The Scottish Government (2009), The RSPCA (2012), Welsh Assembly Government (2008), See Table 3.1.	Legislative literature – not horse specific Synthesis of Fitness for Purpose Criteria – varied in terms of content, literary and experimental content	Legislative literature – not horse specific Synthesis of Fitness for Purpose Criteria – varied in terms of content, literary and experimental content

Chapter Four

4.1. Research Philosophy

Guba and Lincoln (1994) state that both qualitative and quantitative research methods may be used regarding any research paradigm, the paradigm being defined as the world view or the basic belief system which guides the investigation undertaken. Guba and Lincoln (1994) further described research as being bi-layered; research philosophy and the research approach.

Research philosophy is described by Saunders *et. al.* (2009) as being the development of knowledge and the nature of that knowledge, with research specified as the development of knowledge in a particular field, therefore answering the research question. Assumptions will be utilised to underpin the research strategy utilised and the methodology chosen (Saunders *et. al.* 2009). Saunders *et. al.* (2009) further describe that philosophy is influenced by practicalities, the main consideration being the view of the relationship between knowledge and the process by which it is developed.

Johnson and Clarke (2006) differ from Guba and Lincoln (1994) and Saunders *et. al.* (2009), in that the philosophical concept is not the primary concern, the importance being placed upon the research being philosophically informed, reflecting upon philosophical choice and defended in relation to alternatives which could have been adopted.

Saunders *et. al.* (2009) clearly state that regardless of the philosophical approach selected, one method is not “better” than another, just “better” at different things, therefore being better suited to different aspects of research than other philosophical methodologies, thus highlighting the importance of the most appropriate methodology being selected.

Ontology, the nature of reality, questions the assumptions researchers have about the way the world appears, the assumptions being divided into objectivism and subjectivism. Saunders *et. al.* (2009) continues to describe objectivism as how social entities exist independent of social actors, and subjectivism as understanding the meanings that individuals attach to social phenomena, social phenomena being created from perspectives and consequences, both of which are associated with constructionism. Constructionism being described (Saunders *et. al.,* 2009) as the

exploration of the subject meaning motivating actions, and therefore understanding of the actions developing.

The work and philosophies of Guba and Lincoln (1994), Saunders *et. al.* (2009), and Johnson and Clarke (2006) has all been considered regarding addressing the specific research question.

4.1.1. Research Methodology

The concept of research methodology has been thoroughly evaluated taking into account a wide variety of literary works concerning research methods so that the most suitable can be selected to produce a valid research methodology, including the research "onion" concept of Saunders *et. al. (*2009).

Strauss and Corbin (1998) describe many factors associated with high quality research and alternative research philosophies including the distinction between methodology and method. Straus and Corbin (1998) describe the research problem – the major key to all research, as being the general or substantive area of focus for the research. The research question is derived from the research problem, thus being the specific question to be addressed by the research. The research question is utilised to set the exact parameters of the project, and to suggest the appropriate methods which are to be utilised within the process of data gathering and also data analysis. This implies that the specificity of the research question is vital for the correct construction of the research methodology to allow the question to be addressed specifically.

However, Willig (2001) takes a completely different initial slant on research methodology, describing the research process as an adventure, a positive, if risky undertaking to investigate and approach a question, with the creative input to the question formulation of what can be found out?

The work of Straus and Corbin (1998); the research question derived from the research problem was utilised within this study to formulate the 'are stables in current use fit for purpose for the modern Equidae research question. The work of Willig (2001) is also relevant to the study, especially the 'what can be found out' aspect, which is especially relevant to studying the stabling accommodation in current use.

It was concluded that many different elements of the research philosophy are necessary for effective research, but that the research "onion" concept would be

utilised as a framework for deriving the appropriate elements for the research undertaken.

4.1.2. Research "Onion"

This research methods section will be formulated around the Research Onion concept as formulated by Saunders *et. al.* (2009) as illustrated in Fig 4.1.

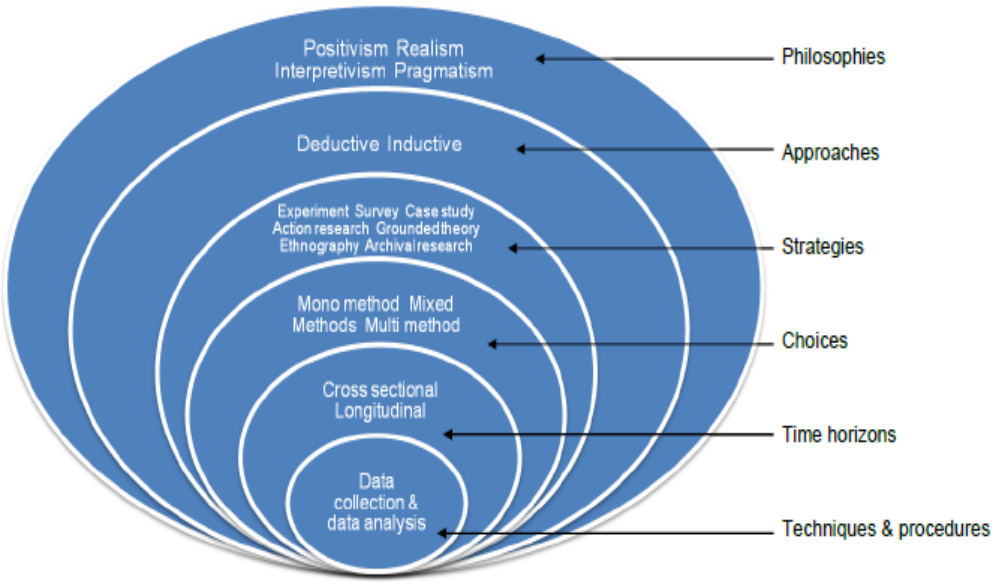


Figure 4.1. The Research "Onion"

Adapted from Saunders *et. al.* (2009)

The "layers" will be addressed individually: Philosophies; Approaches; Strategies; Choices; Time Horizons and Techniques and Procedures.

Research Philosophies

There are four philosophical categories: Positivism; Realism; Interpretivism and Pragmatism. Whilst they are defined as separate categories there is invariably some overlap and interplay between them.

Saunders *et. al.* (2009) described positivism as focussing around the research question, utilising integrated perspectives to help collect and interpret the data collected. Mixed methods being highly appropriate within a single study, utilising both qualitative and quantitative data for the analysis of the data. Tashakkori and Teddlie (1998) clarifies this further by stating "study what interests you and is of value

to you, study in the different ways in which you deem appropriate, and use the results in ways that can bring about positive consequences within your value system".

Positivism is described (Saunders *et. al.,* 2009) as working within the tradition of the natural scientist: what can be "observed" leading to data collection. Therefore utilising existing theories. A hypothesis being tested and confirmed, in whole or in part, which can be further tested by further research; therefore the resultant data being fact rather than impression, being value free, and personal feelings not altering the factual data collated, though it is accepted that feelings may influence the data collection, depending on the technique utilised, as for example, the utilisation of interviews results in the improbability of personal influence not occurring. This can be dealt with by specifically addressing research bias. Saunders *et. al.* (2009) describes the positivist researcher as utilising a structured methodology which enables the facilitation of replication and quantifiable observations, statistical analysis and also the inclusion of non quantifiable observations.

Realism is the second research philosophy described as questioning if objects exist independently of our knowledge of their existence (Saunders *et. al.,* (2009). This is in relation to scientific enquiry and whether objects have an actual existence independently of the human mind, in opposition to the idealism theory that only the mind, and the contents of the mind exist. Realism has similar foundations to positivism, in that it assumes a scientific stance to develop knowledge, achieved by the collection and the interpretation of data.

Realism is subdivided into two distinct categories by Saunders *et. al.* (2009); direct realism and critical realism. Direct realism described simplistically as what you see is what you get, and what you experience through the senses portrays the works accurately. Critical realism differing in the explanation that what we experience are sensations and images of things not real things directly. Critical realism relates to the senses, which can be deceiving, and also illusions, which are insufficiently informed. Direct realism is described as operating on one level, with the world relatively unchanged whereas critical realism is multi layered, with each layer having the capacity to change the researchers understanding (Saunders *et. al.*, 2009).

Interpretivism is the third research philosophy described (Saunders *et. al.,* 2009) as understanding the differences between humans and social actors, social actors being defined by the roles they are expected to adopt, and being a suitable philosophy

concerning research relating to people, rather than objects. To utilise Interpretivism the researcher enters the social worlds of the research subjects understanding their world from their point of view, thus being an important philosophy to utilise concerning marketing campaigns, and similar. Two interpretivist strategies can be utilised; phenomenology, the way in which humans make sense of the world around them and symbolic interactionism, the continual process of interpreting the world, interpreting the actions of others with whom interaction takes place and the interpretation leading to adjustment of own meanings and interactions (Saunders *et. al.,* 2009)

Pragmatism is the fourth research philosophy described (Saunders *et. al.,* 2009) as being an ontological approach in which research is external to the researcher, multiple methods are utilised and a view is selected to best enable the answering of the research question. The epistemological stance being that the researcher regards what constitutes acceptable knowledge, be that observable phenomena and/or subjective meaning to provide an acceptable knowledge dependant on the interpretation of the research data (Saunders *et. al.,* 2009).

Saunders *et. al.* (2009) states that pragmatism is suitable for practically applied research, integrating differing perspectives to help interpret the data collated. Data collection methods utilised for pragmatic research include mixed or multiple method designs, incorporating qualitative and quantitative research.

It was concluded from an evaluation of the foregoing that for this specific study, pragmatism is the most suitable philosophy to select, as the research does not concern people; the researcher is external to the research undertaken; and the views are selected to best answer the research questions posed, in this case; Are stables in current use fit for purpose for the modern Equidae?.

The research question was addressed by a pragmatic philosophy to provide acceptable knowledge which is dependent on the research approach undertaken, and is applied to practical research where methodology suitable to the situation is utilised.

Research Approaches

Deductive and inductive approaches can be utilised separately within the concept of the research layers, or be combined (Saunders *et. al.,* 2009). The deductive

approach investigating theory and hypothesis, with a research strategy structured directly to test the hypothesis, thus being a theory testing approach. The inductive approach concerns collecting data and developing a theory as a result of the data analysis undertaken, thus being theory building (Saunders *et. al.,* 2009).

The deductive approach concerns scientific principals; moving from theory to data with an emphasis on explaining causal relationships between data; utilising controlled data collection techniques to ensure validity; being a highly structured approach; where samples are selected to enable generalisation of data to be undertaken.

The inductive approach concerns understanding and interpreting the meanings humans attach to events; and understanding the research context; utilising qualitative data with a flexible research structure that permits changes within the research emphasis as the research is undertaken; this enables the researcher to be immersed within the research and with limited concern for generalisation, but increased concern for specificity (Saunders *et. al.,* 2009).

Due to the differing approaches available; deductive testing a theory, and inductive building a theory, the inductive approach being applicable where a small study sample is utilised, and qualitative research is conducted. Varying data collection methods can be utilised to establish differing views on the phenomena studied (Saunders *et. al.,* 2009). Combining the two approaches allows for scientific, structured research with an independent researcher undertaking data gathering alongside the building of the theory. This can utilise a small sample and predominantly qualitative data, contextualised to the understanding of the research question.

It was concluded that for this specific study, a combined deductive and inductive mixed approach was the most suitable, as was not restricted to either option, but combines the positive aspects of both options. The research question required a scientific, structured approach to be utilised with the research being independent to the researcher, and also to permit theory to be both tested, and built utilising a relatively small research sample size, and combining quantitative and qualitative research to fully understand the research context. This combined approach then requires the selection of an appropriate research strategy.

Research Strategies

The strategy selected determines the practicalities of the research undertaken and the resultant data collected. The purpose of the strategy "layer" was to determine whether the strategy selection is descriptive, exploratory or explanatory, descriptive focussing upon formulating an accurate profile of persons, events or situations, exploratory searching through a defined phenomena or event, explanatory focussing upon causal relationships between variables (Saunders *et. al.,* 2009).

Saunders *et. al.* (2009) divides the research strategies into the following; stating their appropriate usage:

i) Experiment: A strategy exploratory and explanatory research, typically utilising a research group and a control group. Typically this uses predominantly quantitative data.

ii) Survey: A deductive, descriptive or exploratory approaches, designed to address who, what, where, when and how utilising qualitative data.

iii) Case Study: A strategy involving investigation of a specific phenomenon within context, utilising a variety of evidence sources. The conclusions are limited depending on the data variables which are collected, with data collection techniques being multi-facetted and likely to be combined, including observations, documentation analysis and also interview as appropriate to the individual situation. Quantitative and qualitative data can be gathered but is frequently challenged due to its specificity and lack of generalisation.

To minimise this problem triangulation can be used. It is the utilisation of differing data collection techniques within a single case study that can be compared and contrasted to ensure as far as possible that the data is revealing to the researcher consistent results. It can be used utilising both qualitative and quantitative data as appropriate.

Case study research enables multiple studies to be undertaken, thus establishing findings as occurring (or not) in other cases, so that generalisations can be determined, and that a single research case is not unique or extreme.

Yin (2009) described four case study designs; single; multiple; holistic and embedded. A single case study being utilised (Yin, 2009) in a number of ways to answer the research question; to fully address the case study question; to reflect an extreme or unique case; to reflect a typical or representative case; to be revelatory, where the opportunity has arisen to investigate a single phenomenon which has previously been inaccessible; or where a single study is utilised, but on more than one occasion to produce a longitudinal study.

Due to the limited nature of a single case study, selection is critical to ensure that the study selected does meet the requirements and expectations. An alternative is stated (Yin, 2009) as a multiple case study, where a number of single case studies are utilised to answer the research question. Multiple case studies can be selected to predict similar results (literal replication) or to predict contrasting results, but for reasons which have been anticipated (theoretical replication).

Multiple case study methodology can be holistic or embedded (Yin, 2009). Holistic case studies producing conclusions as a whole, whereas embedded case studies produce conclusions based on sub units studied.

Case study research has been challenged as unscientific in nature, but a worthwhile methodology to exploring theory (Yin, 2009), to challenge existing theory (Yin, 2009) and to provide a source of new research questions.

iv) Action Research: Action research concerns research in action rather than research about action, therefore involving the researcher, practitioners and academics within the research itself. Action research concerns actions taken, evaluated, and further diagnosed with the researcher being heavily involved within the process to answer “how” type questions. It is typically used for research of an exploratory nature seeking to achieve improvement from the current situation. It is predominantly qualitative as it is the change that is the aim, rather than the elicitation of data.

v) Grounded Theory: Grounded research though predominantly inductive in nature includes both inductive and deductive research to predict and explain behaviour to develop and build theory. Grounded theory concerns the collection of data without an initial theoretical framework being in place, so that

the observations generates data, generating predictions which are tested with further observations and testing. Grounded theory data can be qualitative or quantitative.

vi) Ethnography: Ethnography is an inductive approach with an anthropological basis. Ethnography describes and explains the social world the research subjects inhabit in the way in which they would describe and explain it.

To fully understand the strategy, the researcher must fully immerse themselves in the social world being researched, which results in a time consuming process, this does permit patterns to emerge as the observations occur, the process being naturalistic, with extended participant observation. This approach is predominantly qualitative.

vii) Archival research: Archival research concerns the utilisation of administrative records and documentation, including historical and recent data sources as appropriate, but with the data being utilised as a primary data source, not a secondary data source supporting the literary review. Archival research may include both qualitative and quantitative research.

Archival research must be based around the data which is accessible, supporting a literature review as the data available may not be adequate to answer the question posed, it may be missing, or not available to the researcher. Qualitative or quantitative research, or a combination can be utilised to adequately answer the research question.

It was concluded from reviewing all of the above that for this specific study, that the case study was the most suitable research strategy, as it utilises a variety of evidentiary sources in context, with the possibility of triangulation of data collection techniques to enable the data to be verified and, to ensure that the data is informing the research as required.

Within this specific study, both quantitative and qualitative data were collected to address the research aim, and enable different data collection techniques to be utilised within each single case study. The breadth of data collected within each study allowed for the data to be compared and contrasted, producing consistent results. Multiple case studies were utilised within this study, to enable extreme,

unique, typical and representative sites to be studied and included. The use of multiple case studies within this study enabled holistic results and conclusions regarding all the study sites, and also embedded results and conclusions based on each study site (sub unit).

Research Choices

Saunders *et. al.* (2009) categorises choices into two categories; mono methods and multiple methods, which is then sub divided further. Mono methods involves the collection of data utilising a single technique, and utilising a corresponding analysis procedure. Multiple methods concerns data collection utilising more than one data collection technique, and more than one analytic procedure. Multiple methods is sub divided into four categories (Saunders *et. al.,* 2009):

i) Multi methods quantitative: Utilising questionnaires and/or structured interviews with statistical analysis of the data.

ii) Multi methods qualitative: Utilising in depth interviews and diary accounts, with non numerical qualitative analysis.

iii) Mixed methods: Utilising both qualitative and quantitative analytical procedures as appropriate to the data sources. Qualitative and quantitative research can be utilised at the same time, in parallel or one after the other, sequential. Though mixed method research combines qualitative and quantitative techniques, qualitative data is analysed qualitatively and quantitative data is analysed quantitatively, the analysis techniques therefore remain specific to the data collected.

iv) Mixed method research: Similarly to the mixed methods described above, mixed method research combines qualitative and quantitative data collection and analysis procedures, but with mixed method research qualitative data may be analysed quantitatively, and quantitative data may be analysed qualitatively.

Saunders *et. al.,* (2009) states that mixed methods research produces data for different purposes. Bryman (2006) expands further stating that multiple and mixed methods research provides extensive uses for data which they had not anticipated, the outcomes of which may not be predictable, and may produce unexpected results,

but generally can contribute significantly to the creation of contributions to knowledge that are unexpected.

Smith (1981) states that both qualitative and quantitative methods have positive and also negative characteristics, but that there is a distinct relationship between the data collection technique and the results obtained.

Saunders *et. al.* (2009) conclude that the use of more than one research method can counteract the "method effect" of utilising a single methodology, therefore increasing confidence in the conclusions reached. It is stated that research should be considered as "creative", and that the use of clear research aims and objectives for the study will ensure that the methods selected will enable them to be fully met.

It was concluded from an evaluation of the above research choices that mixed methods research would be utilised within this study as it will allowed for extensive qualitative and quantitative analysis of qualitative and quantitative data, thus minimising the potential for method effects, and maximising data analysis, which may provide unexpected results, as well as answering the specific research aims and objectives, and the research question.

Qualitative and quantitative data analysis will be addressed later within this chapter.

Research Time Horizons

Time horizons take into account the timing of the research undertaken, and the length of the time period that the research occurs over. Saunders *et. al.* (2009) defines time horizons into two distinct categories; cross sectional which provides a "snapshot" in time, and longitudinal study, which studies changes and developments over a period of time.

Cross sectional time horizon is a study undertaken at a particular time, therefore case study or interview are commonly utilised research methods (Saunders *et. al.,* 2009). A longitudinal study occurs over a period of time, which may be relatively short, or over an extensive period time, depending on the research study undertaken. Longitudinal study specifically addresses changes and developments over a specified, or non specified period of time, therefore interviews or surveys are commonly utilised methods (Saunders *et. al.,* 2009).

It was concluded from the evaluation of the above that the most suitable research time horizon for this particular study was cross sectional, as it provides a "snapshot" in time, rather than over an extended research period, which may reflect change, rather than what is in place at the present time. This cross section would result in a specific one off study visit for this specific study. The time scale for each study visit may be determined by the site owner/manager, but prior discussion and arrangement would allow adequate time for the necessary data collection to be undertaken.

Research Techniques and Procedures

Saunders *et. al.* (2009) describes that the techniques and procedures utilised must be reliable in that a study is able to yield the same results on other occasions, thus being replicable, and also replicable by other researchers. It should also be transparent in how sense has been made of the raw data collated. Threats to reliability include subject or participant error or bias, observer error and observer bias, which all effect the data collection and the results produced. Techniques and procedures should enhance the validity of the study, ensuring that the findings are accurate, consistent and reliable. Threats to validity may include past history, testing, instrumentation, mortality and maturity and the procedures are selected to minimise or eliminate such threats.

Within this study, the use of a case study aide memoire template and a single data collector (the author) enhances replication and reduces the effect of observer error or bias, and also ensures that the study is transparent and valid.

Saunders *et. al.* (2009) state that ethics are an important factor concerning techniques and procedures, especially where research concerns access to people and organisations, and care must be taken to ensure that those participating in the research are not embarrassed, harmed or materially disadvantaged.

With regard to this specific study, the University of Salford Ethics procedures were adhered to, (though people were not directly involved within the study itself) thus permission was sought via the University Research Ethics Panel via completion of the Ethics Approval Form for Post Graduates, and the study subsequently approved by the panel, thus approving the study methodology regarding ethics.

Saunders *et. al.* (2009) describes data collection as being focussed to yield specific results, and therefore the techniques and procedures, and methodology must be

selected to enable this to occur, recognising that selected methods can be either advantageous or negative to the results. Critical evaluation of both the method and source is required to ensure reliable data. Regarding this specific study, the research question was key to the specific data required to yield the specific data, and thus results and conclusions.

An ideal approach within research would be to examine every potential data source, however if the scale of such sources are large, or very disparate, then examination of each source becomes impractical. Therefore, to undertake the research practically, the examination of a proportion or sample of sources may be undertaken. Within this specific study, 18 case study sites were selected to meet the requirements of the research aims and objectives, and thus the research question.

Saunders *et. al.* (2009) state that sampling techniques and procedures may be purposeful or judgemental (Saunders *et. al.*, 2009), where cases are selected to best enable the answering of the defined research question and meet the objectives. Sample selection is especially important where small sample sizes are utilised, case studies are utilised and where samples are selected to obtain specific information.

Sampling may involve the selection of extreme or deviant cases to reflect unusual or special cases to meet the study objectives, heterogeneous or maximum variation sampling involving data collection to describe and explain key themes, so that patterns may emerge producing varied results and conclusions. Homogenous sampling focuses on the sampling of a specific sub group within research, enabling in depth research within a particular sub group to investigate and define a research question (Saunders *et. al.*, 2009).

Sampling techniques can be selected to suit the individual methodology: stratified, sampling each sub group within a sample; saturation, ensuring that all categories are accounted for; snowball, where respondents refer the researcher to other respondents; opportunist, utilises a “convenient” localised, accessible research population; purposeful, to select a narrow sample which reflects the exact requirements of the study, and random, where samples are randomly selected from a wide sample size.

Case study selection is a form of sampling and can be classified as being (Saunders *et. al.,* 2009) critical or typical. Critical being the selection of cases to illustrate a specific point or because of the specific individual importance of the case. Critical

case study sampling allows for the analysis and interpretation of each individual case, so that some generalisations may be formulated. Typical case study sampling selects random examples, to provide an illustrative representative profile, which is typical to other case study examples. This permits broader generalisation and the proposal of “average” or common features.

The case study samples selected will ensure a reliable, valid and ethical research study. Qualitative and quantitative data collection ensured that the research question can be answered and the study objectives met, with case study samples selected being stratified, saturated and purposeful. This enhances the research data, with the inclusion of both unusual and typical cases to meet the study objectives. This achieves maximum variation across the case studies so that patterns emerge within the results which can be analysed and conclusions formulated. Both critical and typical sampling techniques were incorporated into case studies selected to illustrate key points because of the importance to horse welfare, and also typical case studies selected to provide an illustrative representation across the study.

With regard to this particular study, case study research was selected as the most appropriate methodology to answer the research question. The case study sites were selected individually to best answer the research question and meet the aim and objectives. Case study sites were selected to be heterogeneous and also homogenous, and reflect stratification, saturation and purposeful methodologies to ensure data analysis resulted in valid results and conclusions embedded, and holistically.

The Research “Onion” concept enables the researcher to follow a layered structure, to assess the research options available to them, and to determine the most appropriate methodology to be undertaken, utilising the concepts of philosophy, approach, strategy, choice, time horizons and techniques and procedures.

This specific study utilises the Research Onion as follows:

- Philosophies — Pragmatism, multiple method selected.
- Approaches — Combined deductive and inductive selected.
- Strategies — Case study selected; multiple; holistic and embedded.
- Choices — Mixed methods research selected.

- Time Horizons Cross sectional selected.
- Techniques & Procedures Ethics approval, reliable, replicable & transparent.

4.1.3. Qualitative and Quantitative Data

Qualitative research is described as utilising words, in comparison to quantitative research utilising numerical data, thus relating to the collection of data within a participants setting and the researcher interpreting the data appropriately (Creswell, 2009).

Denzin and Lincoln (1998) describe qualitative research as being the field of enquiry which in its own right cuts across all disciplines, all fields and all subject matter. Qualitative research is considered (Saunders *et. al*., 2009) to be a multi-method approach to research, incorporating many factors, including; studies which have been undertaken; the collection of a variety of empirical material: case study; personal experiences; introspectives; life stories; interviews; observations; historical research; interactional and also visual texts: thus allowing many practical options for the researcher.

Negative aspects of qualitative research include the fact that it can be considered to be journalism, a soft science, unscientifically based, only exploratory, and personally biased, therefore criticism rather than theory based (Denzin and Lincoln, 1998). These negatives which are highlighted also reflect the positives of qualitative research, that the emphasis is placed on the process and the meaning rather than what is examined or measured (Denzin and Lincoln, 1998).

It is further described (Denzin and Lincoln, 1998) that qualitative data must adhere to certain criteria to ensure that credibility can be demonstrated. Internal validity relates to the degree in which the findings of the study correctly map the phenomenon in question. External validation relates to the degree in which the findings can be generalized to other settings similar to the studied location(s). These two validity factors inter relate to the reliability of the study, thus reliability being the extent to which the study can be replicated or reproduced in the future. Objectivity is also important (Denzin and Lincoln, 1998) being the extent to which the findings are free from any bias.

Strauss and Corbin (1998) continue to describe qualitative data in simple terms as a method employed to produce research findings not arrived at by statistical processes

or procedures or other quantifiable methods. Qualitative data being concerned with peoples lives, life experiences, behaviours, emotions, feelings, organisational functioning, social movements, cultural phenomena, and the interaction between nations. The large majority of the data concerned with qualitative research being interpretative.

Qualitative data is described (Kirk and Miller, 1986) as a method to identify the presence or the absence of something, but that the "something" needs prior definition. In contrast, quantitative research is a measurement of the degree to which "something" is present and this is usually in a numerical form, be it numbers or units of measurement. The question of reliability within both qualitative and quantitative research is addressed in that the experience, or manner of questioning and experimentation must be accessible to others, thus deeming the study repeatable and that the results must contain theoretically meaningful variables.

The reason for qualitative research and data to be utilised is related directly to the research problem. The process undertaken being concerned with data from a variety of sources including observations, documents and records, procedures including how the research data will be used and interpreted, and also organised, and lastly the inclusion of both written and verbal reports (Strauss and Corbin, 1998). The predominant qualitative data will define the types of construction and the resources and facilities provided within a stable. the predominant data in this research will be qualitative, however certain elements are appropriately defined by quantitative data. Therefore it is necessary to define and explain quantitative data.

Creswell (1998) defines quantitative data as concerning reduced numbers of variables and great numbers of cases, concerning reduced numbers of cases and greater numbers of variables. Creswell (2009) describes quantitative data as testing objective theories by examining precise relationships among the variables, and being specifically related to the analysis of numbers, thus being in total contrast to qualitative methodology. Fellows and Liu (2008) describe quantitative research as being a snapshot concluding how many, how much; etc. In this research quantitative data will define items such as length and area of stables. Triangulation is a term used to describe when qualitative and quantitative research techniques are utilised together, thus gaining the positives of both methods.

It was concluded that for this specific study and to address the research question, both qualitative and quantitative data were utilised to ensure that both numerical and non numerical data was collated during this case study research. The qualitative and quantitative data was utilised to address the research aim and objectives, and address the research question, resulting in a mixed method approach, as described further below.

4.1.4. Mixed Methods Data Analysis

Mixed method analysis combines the use of both quantitative and qualitative data, thus increasing the robustness of research beyond the use of a single data source and allowing data parameters to be studied in detail. The concurrent use of both methods allows detailed research to be undertaken to provide a comprehensive analysis of the specific research aim (Creswell, 2009).

The methods of analysing the research data are described as utilising three different methods: materialistic inquiry, which utilises a progressive linear ladder of research steps to reach a final conclusion; constructivist inquiry (also known as naturalistic inquiry, interpretivist inquiry and interpretive inquiry), investigating the truth as a result of the research perspective and relative research philosophies, and critical/ecological inquiry, which relates to the reality of the distribution of power and associated inadequacies within the research context of sustainability (Crabtree and Miller, 1999).

As stated above, mixed methods of data analysis was undertaken. The qualitative and quantitative data derived from a pre-defined case study sample population. The use of qualitative and quantitative data, and triangulation techniques as described by Saunders *et. al.* (2009) allowed for the case study data within this study to be compared and contrasted resulting in valid data analysis opportunities and conclusions.

4.1.5. Case Study Data

Crabtree and Miller (1999) describe the use of the case study data within qualitative research as being a goal which is achieved by exploration, description and also explanation. Case study subjects being described as chosen to maximise what can be learnt, so that the sampling method integrates the typical example, the unique example and also the maximum variation example as described previously. The

case study method is employed as a method of gentrifying qualitative data to provide the maximum possible variation across the study criteria. This is a priority of the study sample, being representative of the larger universe, so that the selected case studies represent the criteria as a whole. Replication logic is also employed so that two or more similar/identical cases within the study allow the researcher to investigate the convergence of data, and thus enhance the confidence of the overall findings within the study/studies. Crabtree and Miller (1999) conclude by suggesting that a sensible case study approach would be the use of sampling logic for initial cases, and replication logic for further case study selection. This method allows for the research aim to determine the research method, and not the other way round (the research method to determine the research question).

With the specific use of the case study being of paramount importance within this study Creswell's (1998) data concerning the case study are further utilised. The case study is described as being concerned with a number of things; a programme, an event, and activity or an individual. The case study can be single or multiple sourced, utilising one or more methods of observation, interview, audio-visual material, documents and reports. The case(s) can be situated within a specific setting, be it historical, physical, social or economic depending upon the specific requirements of the study and the research question. The selection of the cases are described as being intrinsic where the focus is on a specific case(s) due to the uniqueness of the study setting (research unit), instrumental where cases are specifically selected to illustrate a specific study point. Where required more than one case study can be utilised, thus being a collective or multiple case study.

Case study research is stated as utilising purposeful sampling, thus cases are specifically selected to demonstrate different perspectives concerning a problem, issue or research question. Creswell (1998) describes that cases can be selected to demonstrate or reflect the ordinary, the accessible and also the unusual. The sampling rationale as previously defined justifies the selected cases necessary to provide the detailed data required to complete the study. The cases selected provide a variety of data to be utilised within the case study to allow for detailed analysis to be undertaken.

Regarding this specific study, as described by Crabtree and Miller (1999) case studies were selected to demonstrate typical, unique and maximum variation examples, to represent the larger 'universe' and answer the specific research

question. Replication logic could then be utilised should the study be replicated in the future. The multiple case study sites (Creswell, 1998) selected are within specific settings to further meet the requirements of the study and facilitate answering the research question.

The unit of analysis of this specific case study research is a site where horses are stabled. Due to the case study site selection methodology, as described previously, the sites reflect a diverse range of stabling facilities, selected to answer the specific research question.

Once the data has been collected (Cresswell, 1998) the case study requires a detailed collation and subsequent write up. This can be undertaken by categorical aggregation where similar instances of data are collated to investigate relevant meaning(s). Direct interpretation occurs when a single instance of an occurrence is investigated for relevant meaning, rather than multiple examples. Pattern establishment investigates (Cresswell, 1998) all possible patterns and correspondence between instances of data whereas naturalistic generalizations are drawn from data analysis to investigate general learning across multiple case studies.

This specific study enabled inter case study data analysis across a number of dimensions, primarily; the age of stables/sites; the number of horses and the type of horse related to each site. Intra case study data analysis was also undertaken concerning the different stabling facilities occurring within the case study sites (as applicable to individual sites), enabling data analysis to reflect differences in facilities within the individual case study sites.

During write up the case study methodology was expected to generate new theory, clearly describe the individual cases studied and analyse the cases which are utilised.

Within this study, the case study approach allowed for all relevant material to be included, both historical information, physical data in terms of building materials, building structure and design, as well as fixtures and fittings. The owners and managers, where available were able to contribute information as to the working practicalities of the stables and the yards as a whole, thus relating the physical make up of the stable yard with the practical use, and adding further relevance to the data, both factual and anecdotal which reflected the care and management and the

expectations of the personnel involved with horse management and care at all levels (Yin, 2009).

Brewer (2007) described in further detail various study methods, including the case study. The case study is described as the method to explore phenomena and to understand them. It is stated that when the case study is utilised a detailed framework is required, which provides the detailed method to contribute to theory building. Brewer (2007) continues to describe the unit of analysis as being of vital importance within the framework, as is the importance of a clearly focussed research question. Within this study, the multiple single cases were investigated utilising a research case study pro forma template as an aide memoire for the researcher (Appendix 4).

Case study multiple methods data analysis was concluded to be the most suitable method to analyse the research data from this particular study, combining extensive on site study at a variety of locations, enabling the gathering of a variety of information including both quantitative and qualitative data specific to each site, and utilising the criteria defined by Saunders *et. al.,* (2009) for case study research.

The case study data analysis structure has been defined as follows:

i) Stabling of differing ages; Pre 1900; Post 1900 pre 1980 and Post 1980;

ii) Stabling of differing numbers of horses; Fewer than 30, 30 – 80, and Above 80;

iii) Stabling of differing types of horse; Commercial and Non Commercial.

Further details concerning the case study site criteria can be found in 6.1.1., 6.1.2. and 6.1.3. below.

Potential research bias has been addressed by the definition of the data analysis structure above, and the use of the pro forma template as an aide memoir (Appendix 4) to record data. The site selection process avoided bias by clarification of the sites relevance within the defined structure, thus ensuring sites were selected specifically for the purpose of answering the research question.

For this study, generalisation and verification was undertaken to ensure that the data reflected what was expected, and data which did not conform to the expected was verified as accurate. Photographic evidence was invaluable to verify the data

collated on the case study pro forma template utilised (Appendix 4), especially where time constraints were in place during the case study visits.

Reliability within this study was addressed by the undertaking of all data collation by a single researcher, therefore opinion differences, and differences in recording and interpretive practices were negated. Accuracy and consistency were maintained throughout the data collection and analysis, again by a single researcher undertaking the data collection and analysis, thus removing the opportunity differences in recording and analytical practices.

The case study research and data analysis methodology utilised has been specifically selected and undertaken to address the specific research question, and thus is focussed towards the study aim and objectives, and allied research question and will not provide data or analysis for additional or different questions concerning stabling.

4.2. Research Methodology – Case Study Cases

The case study has been selected as the appropriate methodology to utilise within this specific study, as detailed previously. The case studies will be utilised to address the aim of the study, the objectives of the study, and the research question. A pilot case study was undertaken to finalise the appropriate practical methodology and utilisation of an appropriate pro forma template as an aide memoire.

4.2.1. Aim of the study

The aim of the study is to investigate whether stables in current use in the UK are Fit for Purpose for modern Equidae (horses, ponies, donkeys and their hybrids).

The literature review has investigated the development of the modern horse, social structures of the horse, social interaction and time budgets of the horse, stabling, health of the horse, management of the horse, the evolution of stables and stable yards and the design and construction of the modern stable and stable yard. Within the literature, there has been very little evidence relating to the modern stable being Fit for Purpose for the modern Equidae, regarding the “expected” defined requirements of a suitable stabling facility.

4.2.2. Objectives of the study

The objectives of the study were to investigate whether stabling in current use in the UK are fit for purpose, and whether current welfare standards correlate with fit for purpose specifications, thus allowing the research question to be accepted or rejected.

The utilisation of case study research fieldwork enabled a comprehensive investigation into stabling currently utilised by the modern Equidae. The case study fieldwork research methodology is defined later.

The objectives will be underpinned by the following framework:

Objective	Research Tools	Outputs required
1. Analysis of welfare requirements of the modern Equidae	Review literature, books, refereed journals and information on relevant websites	Synthesis of literary findings
2. Analysis of evolution of the stable	Review literature, books, refereed journals and information on relevant websites Undertake case study fieldwork	Synthesis of literary findings
3. Synthesise the fitness for use of stables for the modern Equidae	Review literature, books, refereed journals and information on relevant websites Undertake case study fieldwork	Synthesis of literary findings and fieldwork
4. Evaluate the fitness for purpose of stables and provide a framework for future use	Review literature, books, refereed journals and information on relevant websites Undertake case study fieldwork	Synthesis of literary findings and fieldwork Produce a framework for future use

Objective 1: Analysis of welfare requirements of the modern Equidae

An in-depth analysis of the welfare requirements of the modern Equidae was undertaken to ensure that all welfare aspects were addressed within the study. Chapter Two contains all the literature reviewed relating to the welfare requirements analysed within the study.

Objective 2: Analysis of evolution of the stable

An in-depth analysis of the evolution of the stable was undertaken to ensure that the process undertaken to reach today's modern stables was fully researched. Chapter Three contains all the literature reviewed relating to the evolution of the stable, and how evolution occurred for different types of horses. Chapter Three includes a comprehensive review of the design and construction of the modern stable and stable yard, ensuring the literature reviewed and conclusions formulated are fully up to date. Case study fieldwork as well as a comprehensive literature review enabled the objective to be fully met.

Objective 3: Synthesise the fitness for use of stables for the modern Equidae

An in-depth synthesis of the fitness for use of stables for the modern Equidae ensures that current equine welfare legislation is investigated, and stable Fitness for Purpose evaluated regarding the modern Equidae. The research and synthesis undertaken during both the comprehensive literature review and the case study fieldwork enabled the objective to be fully met.

Objective 4: Evaluate the fitness for purpose of stables and provide a framework for future use

An in-depth evaluation of Fitness for Purpose was addressed via the comprehensive literature review, and the case study fieldwork, enabling the resultant data to be analysed, conclusions to be formulated, and recommendations to be made, including the formulation of a framework for future use.

Case study fieldwork was designed to allow consideration of the following facilities:

iv) Stabling of differing ages;

v) Stabling of differing numbers of horses;

vi) Stabling of differing types of horse

To a large extent the stabling studied was restricted to the facilities which could be gained access to, and which are available to study in the original form, or in a converted manner which still allows for the original buildings to be studied. Thus, historic examples that were available to study were in greater numbers in private and aristocratic facilities and to a limited extent commercial facilities due to the majority of

commercial facilities having been extensively converted, or completely demolished and replaced. The historical commercial examples that were available, were generally constrained by access and location, as well as availability at the time of the study.

Modern stabling was generally easier to gain access to, with a large provision with a large proportion of the modern facilities being educational or veterinary facilities, and thus the owners and managers being willing to allow the study to take place. Private and leisure use facility owners and managers were generally willing for study to take place, and took a keen interest in the reasoning for the study, and were willing to contribute and discuss at great length.

The study at each facility undertook both qualitative and quantitative research, in the form of a detailed case study, as justified previously.

4.2.3. Pilot Case Study

A pilot case study was undertaken to determine the practicality and effectiveness of the planned study methodology before the main body of the study was undertaken. The pilot case study site was chosen as being both practical in terms of geographical location, and also in terms of ease of access so that should the case study methodology prove to be problematic in any way, the site could be returned to and further changes to the methodology could be tested, ensuring its inclusion in the final study.

The pilot case study demonstrated that the methodology for gaining the required information provided the necessary data. However the time scale necessary to undertake each study at all but a relatively “basic” stable yard would need to be taken into consideration when scheduling subsequent sites.

It would have been possible to revert to a less detailed level of data collection (English Heritage, 2006), but it was considered that this would not then provide the entire data set required to complete the study in the manner intended. The effect of this being that the forward planning of the study site visits required greater time to be allocated to each site, imposing restrictions on the practicality of visiting more than one site within a day, even if they were relatively close geographically. Extending the survey timescale was chosen as a suitable compromise, as it was considered to be of greater benefit to the study to maintain the expected level of detail gained during

each site visit, and not to compromise on the detail, but to allocate additional time to the study programme.

A case study pro forma template (Appendix 4) was produced to enable consistent collection of the required data.

Following completion of the pilot case study and a review of the methodological process the decision was made to adapt the use of the template for each particular case study site as it had proved to be relatively unwieldy at locations with a number of stable blocks/buildings or where complex building location plans were needed, thus the template was utilised largely as an aide memoire, rather than as an unyielding structural document.

Therefore the case study template was utilised throughout the study as an aide memoire, rather than a standardised document to be completed at each site, ensuring that relevant information was collected for each stable block/building on each site.

The template was designed to capture specific constructional/physical attributes at the case study sites, therefore ventilation was captured within the construction and windows headings, not a specific ventilation heading.

Chapter Five

5. Case Study; Context, Content and Summary

Eighteen case study sites have been selected to reflect the diversity of stabling in current use, enabling the research question to be thoroughly investigated. The sites range in age from [redacted] which dates from the 1500's to [redacted], which was opened in early 2012.

Sites have been chosen to reflect the diversity of stabling utilised currently, including rare thatched stables at [redacted], heavy horse stabling at [redacted]

The number of horses maintained varies across the sites, the smallest stable yards being at [redacted] (5 Nr) and [redacted] London (14 Nr) and the largest being military stabling within London, including The [redacted] previous and current homes at [redacted] (160 Nr) and at [redacted] (160 Nr) and also the [redacted] (260 Nr maximum capacity).

The eighteen sites provide samples from each defined category as follows:

Historic stabling ([redacted])

Modern stabling [redacted]

Commercial stabling [redacted]

Private/leisure stabling [redacted]

Sub categorisation occurs within chapter 6 to provide more detailed analytical evaluation.

The case study sites are listed in date order, taking into account the earliest stables on site.

Case Study Sites

5.1. [redacted]

5.1.1. [redacted]

[redacted]



Figure 5.1. [redacted]

[redacted]

5.1.2. Context

[redacted]

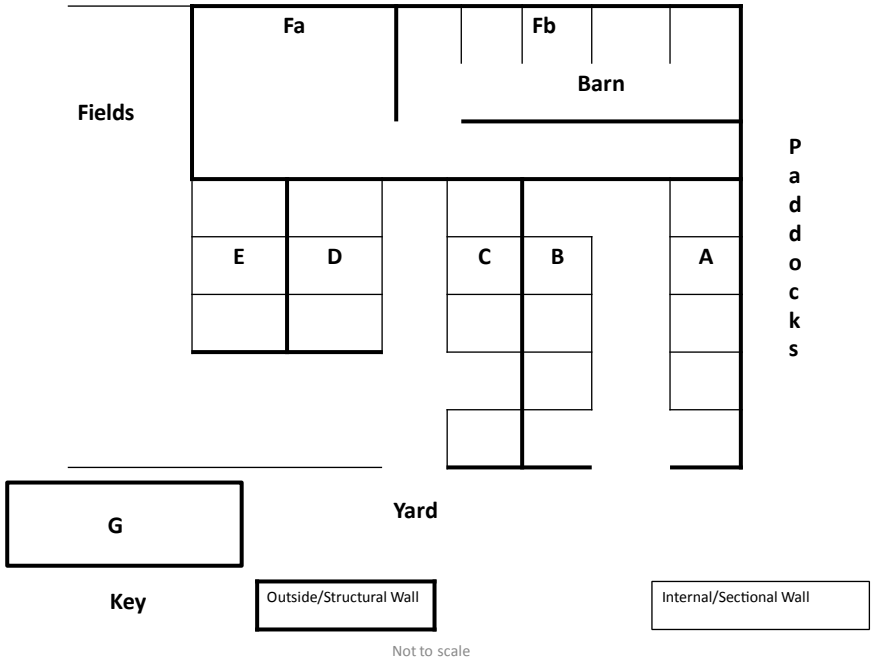


Figure 5.2. [redacted] Yard Plan

5.1.3. Content

[redacted]

5.1.4. Block A Construction

Building A is constructed of soft red brick walls to the rear and the sides, and a timber and metal frame to support a pantile roof, with a concrete floor. There is no drainage provision within the floor structure. The stables have been created by utilising onsite farm labour to construct a timber frame to secure timber panels to the front of the stables and divisional partitions between the stables.

Each stable has a lower half door, but no upper door. In contrast to the expectation that stable doors open outwards, these four stables have doors which open inwards (Figure 5.3.). The doors are secured by a single upper bolt, with the additional

security of a spring clip to prevent the horse being able to open the door itself using its mouth. There are no windows to the front of the stables; each stable having a narrow ventilation gap to the rear between the lower brick wall and an upper section of timber cladding. To the front elevation the timber panels do not reach to the eaves, thus providing additional ventilation at a height above the horses when they are stabled.

PVC rainwater goods take water directly to an open drain covered with a grill which enters the yards drainage system.

Water to the whole yard is provided by a large self filling trough in an adjoining building from which individual buckets are filled for each stable (Figure 5.4.).

5.1.5. Block A Fixtures and Fittings

The stables in Block A have a variety of fixtures and fittings; one stable has no internal fixtures or fittings, and utilises plastic water buckets, two stables have tie rings and utilise plastic water buckets and the fourth contains both tie rings and two metal water bucket holders positioned at approximately horse chest height.

5.1.6. Block B Construction

Directly opposite the cart lodge (Block A) is building (B) of identical structure, recently converted to stabling but utilising commercially available sectional stabling to form stable fronts and internal divisions.

The rear wall is full height soft red brick which also forms the rear wall of further stables which are directly behind this block. The floor is concrete, providing drainage via the doorways. The sectional stable fronts and divisions are timber within a metal frame, the divisional partitions being solid timber and the front of the stables being timber to the height of the stable door, with metal bars above. There are no windows.

Each stable has a traditional timber lower half door, but no upper door. The door is secured by an upper bolt and a lower kick bolt.

In front of the stables is a relatively deep open drainage channel into which the PVC rainwater goods discharge, the channel feeding into the drainage system.

Adjacent to the stables is an open area utilised for storing dust free bedding, the water supply trough and the yard toilet.

5.1.7. Block B Fixtures and Fittings

The stables have no internal fixtures and fittings.

Water for these stables is provided by individual plastic buckets filled from the self filling water trough described above.

5.1.8. Block C Construction

Behind the row of stables described above is another yard formed by two rows of stables facing each other, the first of these rows sharing a common wall with the block described above (Block B).

Buildings to the East being an open fronted cart lodge providing an open fronted storage area, two stables, an open fronted area where horses can be tied for grooming etc and a further stable. The cart lodge is timber framed with a pantiled roof and concrete floor, draining into the yard via the doorways. Timber cladding forms the frontage of the building and concrete blockwork internally to form the internal wall divisions. The timber cladding reaches to the eaves whereas the divisional walls are lower, providing ventilation across the building.

Each stable has a lower half stable door which is secured by an upper sliding bolt. There are no top doors. There are no windows.

PVC rainwater goods drain into an open grate beside the yard water tap.

5.1.9. Block C Fixtures and Fittings

The stables have no internal fixtures or fittings.

Water is provided in individual plastic buckets from a tap adjacent to the single stable.

5.1.10. Block D Construction

Opposite this row of stables are a further three stables, again in a timber framed, pantiled roofed building, a soft red brick rear wall to full eaves height. As previously the front of the building is timber clad, with concrete block internal divisions and concrete floors draining via the doorway into the yard.

Each stable has a lower half stable door which is secured by an upper sliding bolt. There are no top doors. There are no windows.

PVC rainwater goods feed into a drain at the end of the building.

Water is provided by a single tap as described above.

5.1.11. Block D Fixtures and Fittings

There are no fixtures or fittings.

5.1.12. Block E Construction

Behind the previously mentioned yards is a further row of three stables within a recently constructed lean-to building utilising an original soft red brick wall to the rear.

A timber frame supports a plastic sheet roof; the floors are concrete without any integral drainage, the side and internal walls being sectional timber. The front walls are sectional construction with a timber lower section with metal grills above.

Lower half stable doors are secured by a sliding bolt to the top, and a kick over bolt to the base. There are no upper doors. There are no windows.

PVC rainwater goods drain into the yard drainage system.

Water is supplied in individual buckets using the yard tap previously described.

5.1.13. Block E Fixtures and Fittings

There are no fixtures or fittings.

5.1.14. Block F Construction

Adjacent is a Grade II listed timber framed and clad barn (Fa) with a pan tiled roof utilised for short term consumable storage (hay and straw). The floor is of concrete construction, without any drainage provision.

Concrete steps lead from the rear of the barn into a lean-to building (Fb) which provides additional stabling for four horses in a self contained yard.

The lean-to building is timber framed with timber cladding to the rear, sides and front, with a plastic sheet roof and a concrete floor, without drainage. The yard has an entrance alongside the row of stables, which are positioned along the rear wall facing the main barn wall and also large timber doors at the end of the row providing a second entrance.

Sectional stabling identical to that previously described provides the front and the sides of the four stables, with the exception that the divisions between the two end stables and their neighbours are as the front of the stables; timber lower section and metal bars above. The two central stables have a solid timber partition between them.

Lower stable doors have upper sliding bolts and lower kick bolts. There are no upper doors. There are no windows.

Water is supplied in individual buckets via a water tap adjacent to the main exit doorway of the yard.

There is no drainage within the yard.

A concrete area to the front and side of the stables provides a storage area and an area where horses can be tied up under cover for routine care.

5.1.15. Block F Fixtures and Fittings

There are no fixtures or fittings.

5.1.16. Block G Construction

Further stables within the site utilise another Grade II listed building, to provide a range of feed/storage rooms, three stables and further storage areas utilised by the farm.

The building is timber framed and timber clad with a pantiled roof. The ground floor is utilised as stables and storage, the first floor being a traditional (unused) hay loft. The ground floor has a concrete floor without any drainage provision. There are no rainwater goods. The stables have timber divisions to ceiling height, concrete floors and built-in timber mangers in a rear corner.

The feed/storage room exhibits examples of previous utilisation, the occupants being the working farm horses. The feed/storage room demonstrates that the horses would have been secured in two opposite rows within the one room, there still being timber hay racks and timber mangers running the full length of the two walls where the horses would have been tied. There is no longer any evidence of the manner in which these horses would have been stalled, except for a number of tie rings remaining on the front of the mangers, thus indicating that the horses were tied in a

row, which suggests that they were stalled rather than having individual stables but no stall divisions remain. The room provides no ventilation apart from a small door to the front and to the rear.

The doors are secured with a variety of bolts and clips, and each stable has a small open window to the rear.

Yard drainage is via a central yard grate into the farm drainage system.

Water is supplied in individual buckets via a tap adjacent to the domestic building range.

5.1.17. Block G Fixtures and Fittings

There are no fixtures or fitting apart from the pre mentioned built in mangers.

5.1.18. Critical Appraisal

[redacted] demonstrates a variety of stabling provisions within a number of converted buildings but no longer utilises the original farm horse stalling, thus confirming the literature review which indicates a general trend of movement from stalls to stables (Brock, 1937., Powell, 1991., Worsley, 2004.).

Contrary to the literature review (Brock, 1937, Canning, 1991) the majority of the stables do not have an upper stable door which can be closed in inclement weather but this is ameliorated by the stables being relatively sheltered and not greatly exposed to the elements. The lack of an upper half stable door does not conform with the DEFRA (2006) standard. However the location ameliorates the effect of this failing and subjectively meets the intent of Fitness for Purpose, which is returned to in the conclusions and recommendations.

The lower doors exhibit a variety of fastenings, again many away from the norm (Canning, 1991, Chapelstone, 2009) of an upper bolt and a lower kick over bolt. This largely demonstrates the use of practical alternative fastenings which are both secure and easy to use, especially with the addition of a spring clip to prevent the horse opening the top bolt and releasing itself.

The use of four stable doors which open inwards (Figure 5.3.) contrast from the expected (Brock, 1937, Canning, 1991) but is practical since should the occupant try

to leave the stable the door will shut rather than being forced open allowing the horse to escape.

Fixtures and fittings provision is varied demonstrating that these have been added as additions following the initial construction of the stables as the need has arisen, thus not being utilised as standard across each stable.

The stables as a whole demonstrate a lack of windows but adequate light and ventilation due to the use of timber boarding providing gaps between walls and eaves and also that in the majority of the stables divisional walls do not reach the roof, thus providing additional ventilation across the stable building. This is also the case where modern sectional stabling divisions have been utilised. Water is provided at convenient intervals around the yard, both by individual water taps, and also by the use of one self filling trough (Figure 5.4) from which water buckets are filled. This provides both a ready source of water without the need to wait for individual buckets to be filled via the tap but also a fire fighting facility.

Hay and bedding storage is central to the yard, with feed storage areas being distributed around the yard to enable the separate yard areas to have a convenient store close by. The yard has an all weather flood light exercise arena which can be utilised by the livery clients after work when it is dark, a horse walker to increase the exercise provision and also extensive grazing pastures including pastures which exhibit old grass swards and also more recently sown grass mixtures providing varied forage and turn out areas.



Figure 5.3. Pictorial view of Inward Opening Stable Door



Figure 5.4. Pictorial view of Water Trough

5.2. [redacted]

5.2.1. Introduction and Location

[redacted]



Figure 5.5. [redacted] Location Map

[redacted]

5.2.2. Context

[redacted]

[redacted]

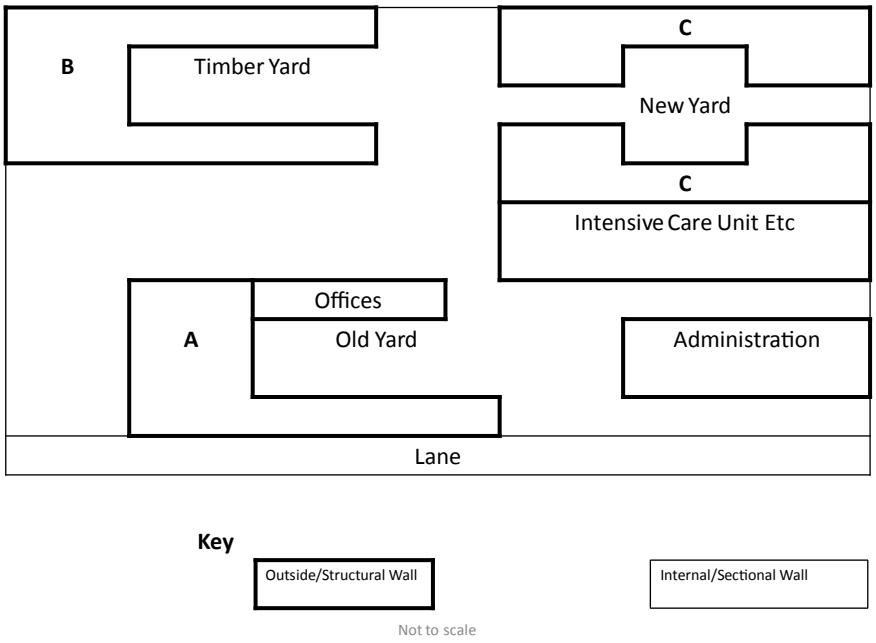


Figure 5.6. [redacted] Yard Plan

5.2.3. Content

[redacted] is currently managed over three separate yards (Figure 5.6.), one being the old yard of brick stables with slate roofs (A), one being a newer yard of timber stables (B) and the third being a more recent yard of blocks with tiled roofs (C). [redacted]. During the 1800's the site was utilised as a private training yard for the estate, and the old yard (A) is what remains of this yard.

5.2.4. Block A Construction

The old yard forms an L shape close to the administrative centre of the site. The stable building is brick built with a slate roof, and concrete floor which is rubber covered. The stables are painted internally and externally; black at the base of the walls, with the top section being white (Figure 5.7.).

Each stable has the appearance of a traditional stable half door with a metal grill, but the doors are actually constructed with a solid timber lower section, with a timber frame and grill making up the top section of the door. The top section has an integral top door to cover the grill as necessary, and to give the appearance of the traditional stable door. The doors have a kick bolt towards the base and a bolt towards the top of the lower section.

There are no windows, though each stable has a small ventilation grill in the front wall.

PVC rainwater goods drain rainwater into the yard drainage system. Externally the yard is concreted, and fenced to provide a secure area.

Water is supplied via individual buckets via a yard water tap.

5.2.5. Block A Fixtures and Fittings

Internally the stables have corner mangers, and tie rings suitable for both securing a horse and/or a hay net.

5.2.6. Block B Construction

A yard of timber sectional stables forming a U shape is located close to the old yard. These stables are utilised by day patients rather than longer term residents.

The stables are constructed of timber, with a concrete tiled roof, which forms an overhang to the front of the stables. The floor is concrete and drains via the door onto the concrete yard.

The stable doors are similar to those in the old yard, except that they are constructed of the traditional half stable door style, which has a metal plate covering the top section (approximately top 1/3) to prevent it being chewed and damaged, and a metal grill is secured to the top of the door to prevent the occupant putting its head over the lower section. A timber top door is secured open, but can be closed as

necessary. To the rear of each stable is a louvred window that allows for additional ventilation to be controlled.

Water is supplied via individual buckets and a yard water tap.

PVC rainwater goods take rain water onto the concrete yard.

5.2.7. Block B Fixtures and Fittings

Fixtures and fittings are limited to tie rings for securing horses and/or haynets.

5.2.8. Block C Construction

The third yard was constructed during the last decade of the twentieth century. The yard is made up largely of two separate sections, with the second section backing into the first to form a rectangular courtyard. Purpose built stabling and foaling stables, with an elegant archway with a clock tower at one end and a central lawn area for a yard to accommodate horses that are not day patients, with the second building containing the ICU which houses six specialist stables which are indoors, but back on to the previous yard.

The yard is constructed of block with a tiled roof and concrete floor.

The stable doors are of traditional style with a lower door with top bolt and lower kick bolt. The upper doors are completely metal lined to prevent chewing. To the rear of each stable is a grilled window to aid ventilation.

Water is supplied via the individual bucket secured to the wall on a metal bracket, water supplied via a yard tap.

Yard drainage is provided via metal grilled drains into a central yard drainage system.

5.2.9. Block C Fixtures and Fittings

Internally fixtures and fittings include tie rings, a corner manger and a corner water bucket set into a metal holder.

Each stable has heat lamps, and hooks for fluid administration and integral CCTV allowing for around the clock monitoring without causing a disturbance by manually checking the horses. The ICU is situated adjacent to the site offices and personnel facilities thus being convenient for the care of the very sick horse.

5.2.10. Critical Appraisal

[redacted]

[redacted]

Stable doors on the original yard, (Block A) though appearing to be of the traditional design are actually a fully height door with an upper metal grill section which can be covered by an integral top door if required, they do have a lower kick bolt and an upper bolt as expected on a traditional door. This grill within the door provides the only ventilation within these stables.

Block B has ventilation provided via a grill on top of the lower stable door, but there is a separate traditional upper door secured open. Further ventilation is provided via a window at the rear of the stable. The use of rear windows is common with the modern yard, but this yard makes use of traditional stable doors, without a grill which is different to the older two yards on site.

Fixtures and fittings vary across the stables with integral corner mangers and tie rings provided. The ICU stables having extensive fixtures and fittings, heat lamps, CCTV and hooks for fluid administration to allow for quality care and ease of staff working.



Figure 5.7. Pictorial view of the Old Yard

5.3. [redacted]

5.3.1. Introduction and Location

[redacted]



Figure 5.8. [redacted] Location Map

[redacted]

5.3.2. Context

[redacted]

[redacted]

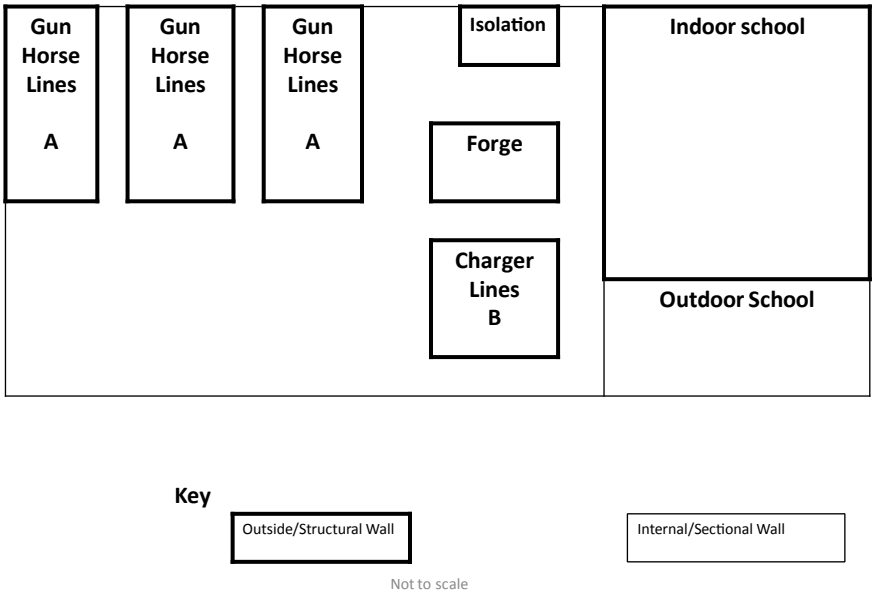


Figure 5.9. [redacted] Yard Plan

5.3.3. Content

[redacted]

5.3.4. Block A Construction

[redacted]

Each barn is constructed of red brick, with a pitched felt roof and a floor constructed of square cobbles to aid grip and drainage.

At each end of the barn are timber stable doors the full height of the walls to provide access and additional ventilation and light when open.

A row of narrow windows run the full length of the brick wall, both along the sides and also at both ends of the buildings. The pitched roof allows for an additional row of windows to run along the higher side of the pitched roof, thus increasing ventilation. The windows set within the brick walls are hinged along the base, allowing them to open inwards at the top in the traditional stable manner, but the identical windows set within the pitched roof are totally opposite being hinged at the top and opening outwards.

The floor throughout is square cobbled, with a shallow open drainage gully running the full length of the barn along the central corridor and outside into the yard drainage system.

The stalls are mainly divided by solid timber partitions to approximately horse eye height, some with a metal grill above, but not all. The partitions are made up of stacked sleepers set between concrete pillars to the front of the horse and rounded metal pillars to the rear of the horse. The partitions are painted black, with the rear pillar above partition height painted brown and having attached a saddle and bridle rack at approximately horse's ears height for temporary storage use.

Within each barn there are a number of stalls which have been altered over time to create stables. These stables have been created by removing the dividing partition sleepers and using them to block up the front of a stall and create a temporary doorway at the front of the adjacent stall, thus turning two stalls into a stable, but a stable that can easily be turned back into two stalls as necessary. Where this has occurred two stalls have been divided by the use of a rounded hanging rail, secured to the front and rear pillars by chain or a rope loop.

5.3.5. Blocks A Fixtures and Fittings

The internal structure of the barns is similar, stalls/stables running the full length of the barn each side of a central corridor with automatic waterers and corner mangers for each horse, and tie rings for securing the horses.

5.3.6. Block B Construction

In contrast, all the charger (officer) horses are stabled, not stalled, within a separate charger lines complex constructed in an identical fashion to the gunner line barns, thus red brick, pitched felt roof and square cobbled floor.

The charger stables are positioned in two rows which face each other across a central walkway, which is square cobbled with a shallow drainage channel along the front of each row in a similar manner to the gun horse lines (Figure 5.11.). The stables are divided by red brick walls which match the outer construction of the building, each stable having a lower half stable door without the upper half to the front. Identical windows to the gunner barns are present providing ventilation and light at the rear of the stables and also the sides (end stables).

5.3.7. Block B Fixtures and Fittings

[redacted]

Isolation stables are situated away from both gun horses and chargers but due to the constraints of the site are still relatively close, and also in close proximity to the farriery workshop and the exercise arenas (both indoor and outdoor) thus the disease risk is reduced, but only as much as the site size and layout will allow. Further study of the isolation stables was not possible due to the disease risk at the time of study.

The Listed indoor riding arena is white painted brick inside and outside, with a sheet roof containing clear skylight sheets. Along one long side of the building are large arched windows, and to the other long side smaller, high arched windows to provide natural light. Close to the indoor arena is a floodlit outdoor arena.

5.3.8. Critical Appraisal

[redacted]

sections. The barn buildings provide well ventilated and lit accommodation, but the majority use of stalling is questionable though it must be appreciated that the occupants are working horses and not leisure horses. The use of the stable in preference to the stall in certain cases is reflected by the fact that stalls have been amalgamated to produce a small number of stables for gun horses which require

greater space and freedom than stalls provide. This is reflected in the work of Brock (1937), Powell (1991) and Worsley (2004) concerning the move away from the use of stalls and to the use of to stables. The use of automatic waterers and corner mangers demonstrate the attention to minimal labour use.

The use of stables (B) for the [redacted] horses reflects their social status that though they are still working horses they are not stalled. Again ventilation and light is provided throughout the building, and automatic waterers and corner mangers reduce labour.

The use of specifically designed forage soaking facilities demonstrate adherence to current management practices, and the construction of facilities to enable ease of working to undertake the task.

[redacted]



Figure 5.10. Pictorial view of [redacted] Horse Lines



Figure 5.11. Pictorial view of [redacted] Lines

5.4. [redacted]

5.4.1. Introduction and Location

[redacted]



Figure 5.12. [redacted] Location Map

[redacted]

5.4.2. Context

[redacted]

[redacted]

[redacted]

[redacted]

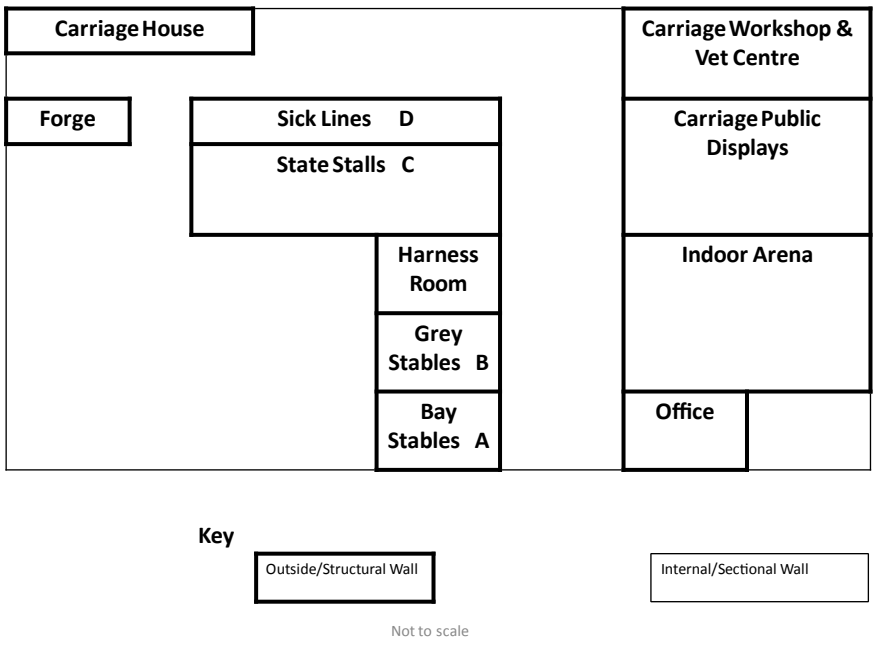


Figure 5.13. [redacted] Yard Plan

5.4.3. Content

[redacted]

The indoor school is constructed of stone to match the surrounding walls and buildings, and has a sheet roof set onto a metal frame. Internally the lower walls are timber clad to provide kick boards around the edge of the area that the horses are ridden in, with the upper section being rendered and plastered to depict ornate pillars set into the walls between the windows. Additional lighting is positioned at the base of the roof. As well as the horses being exercised within the indoor school, they are exercised via London's roads and parks (where permitted) under saddle and in harness, including the twice daily internal carriage mail run which services all the Royal London households (Royal Collection Enterprises Ltd, 2011, Stewart – Wilson, 1991).

Adjacent to the indoor arena is an extensive carriage repair workshop and an onsite veterinary centre. Across a central courtyard from the indoor school and the building which now houses a number of carriages and cars which are on view to visitors are the original stables though these have been altered internally since they were constructed (Royal Collection Enterprises Ltd, 2011, Stewart – Wilson, 1991).

5.4.3. Block A and Block B Construction

The main courtyard building is constructed of London white bricks with slate roof, the stabling being on the ground floor with domestic staff accommodation above. The stables have been converted since the late nineteen ninety's with the original stalls converted into individual stables.

There are two separate internal stable yards which almost adjoin and are similar in design, but house different horses, there being separate stables for bay horses (Figure 5.14. pp146) and grey horses (Figure 5.15.).

Each stable yard was designed to accommodate sixteen horses in two rows of stalls with a tack room dividing the rows. Alterations changed the stalls into stables, reducing eight stalls in each row to four stables, therefore housing eight bay horses and eight grey horses in the two separate yards.

These stable yards are constructed of London white brick, slate roof and concrete floors which are herringbone tiled. The stables have timber cladding along the lower section of the rear and side walls, and within the dividing walls. The upper section of the rear wall is tiled with green hexagonal tiles, the side walls are painted white.

The internal stable walls and the front of the stables are topped with ornate metal grills, round metal pillars reaching the ceiling at the front of each dividing wall and an identical but shorter pillar being positioned alongside the stable door, topped with an ornate gold knob. The metal grills differ between the grey horses stable and the bay horses stable; being horizontal across the front of the stables, and arched along the dividing walls, lower at the front and higher at the rear in the grey horse stables, but much higher and horizontal both at the front of the stable and across the dividing wall in the bay horses stable.

Ventilation is produced via high windows to the front and rear of the stables. The windows appear to be of traditional design, but do not hinge at the base, opening inwards at the top, but the pivot being half way up the window.

Water is provided in individual buckets via a yard tap.

Drainage occurs via the herringbone yard into drainage grills, leading into the yard drainage system.

Within each of the two separate yards the tack room is central and can be accessed from each side. Adjacent to the tack room on each side is a wide herringbone patterned floor which leads into a shallow concrete gully and onto a narrow square tiles strip just in front of the stables. The tack rooms both within the grey horse stable and the bay horse stable provides tack and equipment storage for ridden tack and harness, and the horses are generally utilised both under saddle and in harness, and require day to day equipment for both activities.

5.4.4. Block A and Block B Fixtures and Fittings

Internally each stable has a tie ring and a corner manger secured in a metal holder.

5.4.5. Block C Construction

Towards the rear of the main courtyard is a large building containing stalls. The stalls are rarely utilised today except for days when [redacted] has the horses displayed for her inspection, and they are presented within the stalls. The building is constructed identically to the other buildings within the main courtyard, with an elaborate white painted vaulted ceiling. The pillars to secure the ceiling form the division points between each pair of stalls.

Internally the building complements the stables, the rear walls are tiled with green hexagonal tiles, the dividing walls are timbered at the lower section and have shaped metal grills above, and the front wall lower section is timbered to match the partitions.

Arched windows are positioned high on the wall above each stall to provide ventilation and there are lamps hanging centrally from each vaulting support arch to provide additional light into the stalls. These are electric lights, but these are designed to resemble the original gas lights which would have been utilised when the stables were first constructed. The floor of the stalls is tiled, in a similar fashion to the central corridor which the two rows of stalls head off. The central corridor is now carpeted for the convenience of visitors, but due to the slippery nature of the tiles when the stalls were utilised by the intended horses, the central corridor was covered in silver sand to prevent the horses slipping, and allowing them to grip. This was counteracted within the stalls by utilising a deep bed.

5.4.6. Block C Fixtures and Fittings

A manger runs the full width of each stall at the front (Figure 5.16.). The manger contains a metal feed manger and a separate metal water bowl, and above the manger is a central tie ring to secure the horse.

5.4.7. Block D Construction

Behind the main courtyard, and away from the area [redacted] (Figure 5.17.). These stables are a single row of stables facing onto a large yard which is backed by [redacted] which provide stabling for eight horses are constructed of red cinder bricks, being the cheaper option as not on public display with a slate roof and concrete floor.

The [redacted] have central timber stable half doors, the top section metal clad to prevent damage. There are no upper half doors, but to each side of the upper (open) section of the door is a glazed window which opens outward, revealing a metal grill positioned behind to prevent the horse sticking its head out of the window recess.

Drainage occurs via the stable door, into drainage grates set at intervals in the yard along the stable wall.

Internally the walls are painted with the lower section black, and the upper section white.

The [redacted] have a separate tack room and allied facilities. [redacted] are utilised as day to day stabling, though it is understood that when all the stalling was utilised, the [redacted] would have been maintained for the older and sick horses to aid their recovery in more spacious accommodation. Manure storage occurs on site and is utilised by [redacted]

5.4.8. Block D Fixtures and Fittings

Fixtures and fittings include two deep ceramic mangers in the rear corners of the stable. Water is supplied by individual water buckets (which are all red) from a yard tap.

5.4.9. Critical Appraisal

[redacted]

The stable yards (A and B) demonstrate attention to hygiene, with the use of wall tiles to aid cleaning and also to reflect light. Light and ventilation is provided by large windows and the use of metal grills in the upper divisions between the stables enables free air flow, as do the high ceilings. The yards demonstrate the practice of removing stalls and utilising stables in their place, reflecting accepted management practices.

The stall area (C) is now rarely used, but reflects attention to hygiene, light and ventilation as in the stables, the significant difference being that the floor is tiled, in

what can be deemed an unsuitable material due to the high slip risk throughout the stall building.

The [redacted] (D) continue to reflect the importance of light and ventilation, having windows alongside the stable doors which can be opened and are grilled, but do not have the tiled floors of the stalls. The stable doors are centrally positioned instead of the common position to one side of centre and do not have an upper half door, due to the sheltered position opposite a high garden wall. These stables are constructed of red cinder bricks, demonstrating their lesser status than the white brick ornate buildings on public view.

Water is provided throughout the horse accommodation by plastic water bucket, but every stable in the [redacted] has two ceramic corner mangers which are not seen elsewhere on the site. This could suggest that the attention to detail for the sick horses was greater than for the healthy horses in the other accommodation.

The horse accommodation does not obviously demonstrate poor building construction or design, or beetle infestation as described above, though these facts were referred to during the site visit.



Figure 5.14. Pictorial view of [redacted] Stable Block



Figure 5.15. Pictorial view of [redacted] Stable Block



Figure 5.16. Pictorial view of Stalls

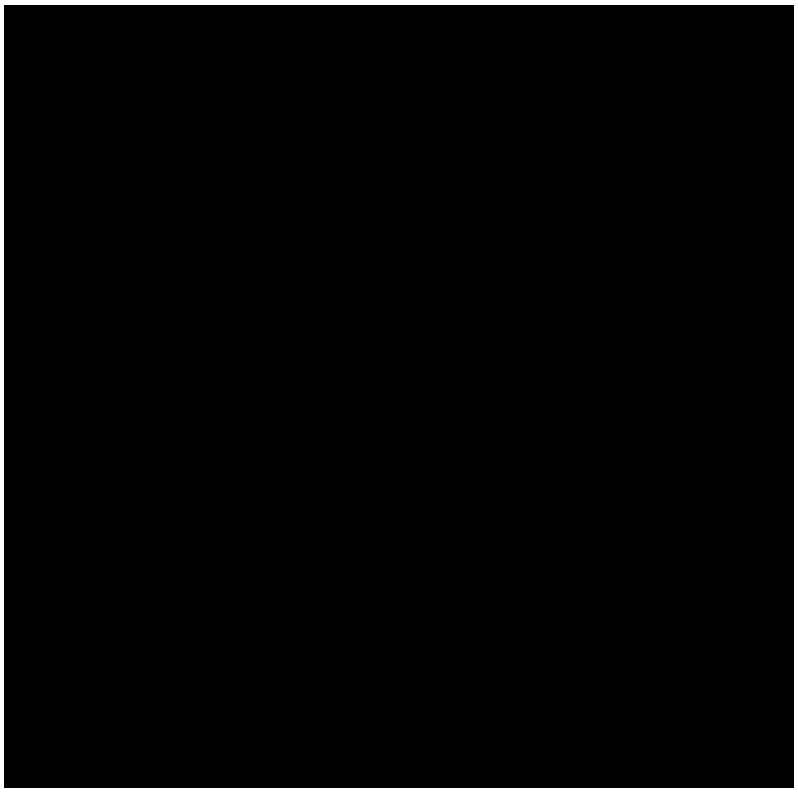


Figure 5.17. Pictorial view of [redacted]

5.5. [redacted]

5.5.1. Introduction and Location

[redacted]



Figure 5.18. [redacted] Location Map

[redacted]

5.5.2. Context

[redacted]

[redacted]

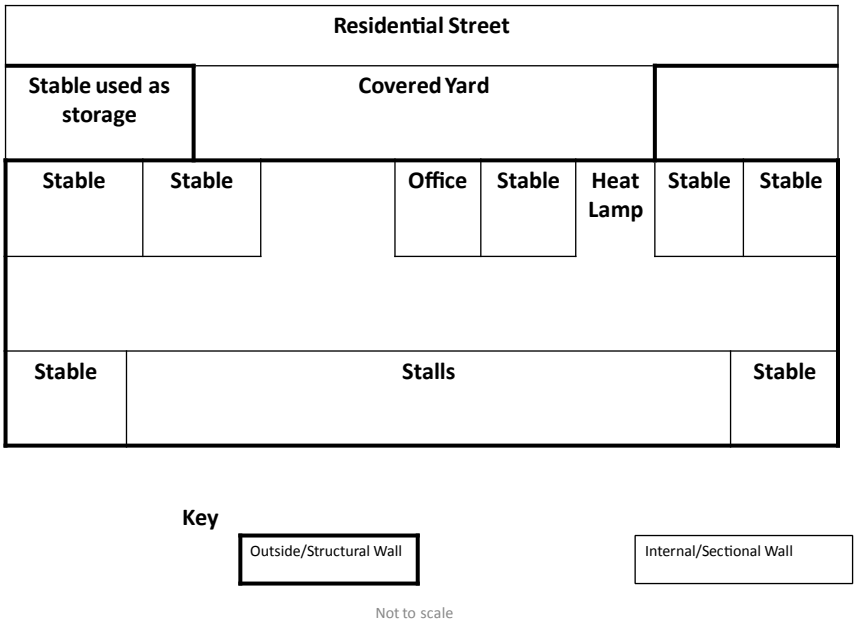


Figure 5.19. [redacted] Yard Plan

5.5.3. Content

[redacted]

5.5.4. Construction

In contrast the stable block, situated to the rear of the main building, is constructed of block and white concrete with curved corners, a flat concrete roof, and concrete floor. Above the stables are two separate flats, originally to serve as married quarters for police officers, which are reached by separate entrances from the road (English Heritage, 2010).

The stable block (Figure 5.19.) is accessed via a personnel doorway from the rear of the main building, or via a traditional stable door into a covered area alongside the stable yard.

The stable area has narrow horizontal domed roof lights in the stable area, with additional fluorescent strip lights. The windows do not open, therefore the only ventilation is provided via the two doorways.

Internally the building was originally designed to accommodate horses in stalls on each side of a central corridor/walkway. This design largely remains today, the only difference being that instead of stalls along each side of the building there is now a mixture of stalls and stables. The building retains the original floor surfaces and stall partitioning demonstrating continual use for horses (Figure 5.20.), and the original forge chimney towards the rear of the building.

The stalls are divided by walls made of block, a timber grill with a thick timber strip along the top at the head end so that the occupants can see but not touch each other.

Each stall has a herringbone patterned concrete floor to allow drainage into a rear gully and metal covered drain which runs the length of the building. To prevent bedding moving out of the rear of the stall and blocking the drains wooden sleepers are placed at the rear of the stall which the horse steps over when moving into and out of the stalls.

Some of the original stalls have been replaced by sectional stabling to allow a horse which requires it, a greater degree of space than a stall provides. The dividing sectional stables and front walls have a timber lower section and metal grill upper section.

Sliding doors are utilised, rather than hinged doors which would impinge on the narrow central corridor which runs the full length of the building.

There is a narrow stall space between two of the stables which has heat lamps above allowing horses to be easily dried following washing or exercise without getting cold.

A redundant stable to the outside of the building is currently used for storage but exhibits signs of having been a stable, possibly for a large horse or for a senior officer. This stable has a high glazed window which opens in the traditional stable manner with a hinge at the base.

The yard has allied tack and feed rooms, and a covered area where bedding is stored. Originally the space above the stables accommodated officers, but no police officers live on site today, though the station is manned at all times.

The stable yard provides no exercise area or turn out area, thus the horses are exercised straight onto the road at the side of the yard, which is largely a residential area.

5.5.5. Fixtures and Fittings

Each stall has a boxed in metal feed manger and automatic waterer, and a retracting lead rope system placed centrally at the head end of the stall to allow the secured horse to move within the stall (Figure 5.21.) without becoming tangled with a trailing lead rope (Figure 5.22.).

5.5.6. Critical Appraisal

The stabling provision demonstrates the use of a historic building that has been altered to house the required number of horses within a restricted building area where expansion is not otherwise possible, but it has been possible to incorporate a number of features associated with modern horse management.

Traditional stalls are utilised but have relatively recent additions of automatic waterers and metal feed mangers. The use of timber sleepers at the rear of each stall to prevent bedding being moved into the central isle or blocking the drains reflects the need of the current bedding type, wood shavings, whilst historically straw bedding would have been used.

Each stall utilises a retracting lead rope system to allow the horse limited movement without the risk of the rope becoming loose and tangling the horse.

The removal of a number of stalls and the addition of a small number of stables reflects the acceptance that stables are preferable to stalls, but within this site space is severely restricted and the required number of horses would not be able to be accommodated in stables.

The stables utilise sliding stable doors so that the central isle does not become blocked in any way. Ventilation is limited but light is plentiful due to extensive use of skylights which unfortunately do not provide ventilation, and artificial lighting is provided throughout.

There is no turn out or grazing provision and the horses are exercised straight onto a road but there is a nearby park providing an off road exercise opportunity.



Figure 5.20. Pictorial view of Stables and Stalls



Figure 5.21. Pictorial view of Stall Showing Manger, Waterer and Tie Mechanism

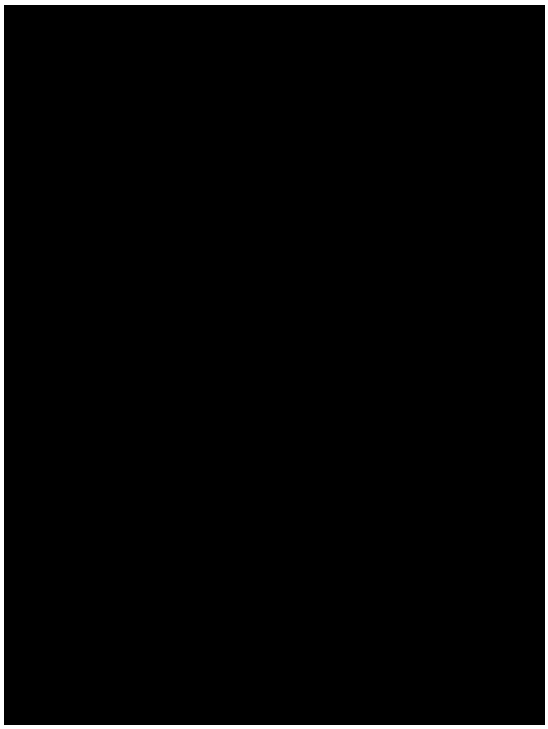


Figure 5.22. Pictorial view of Stall Showing Tie Mechanism in Operation

5.6. [redacted]

5.6.1. Introduction and location

[redacted]



Figure 5.23. [redacted] Location Map

[redacted]

5.6.2. Context

[redacted]

[redacted]

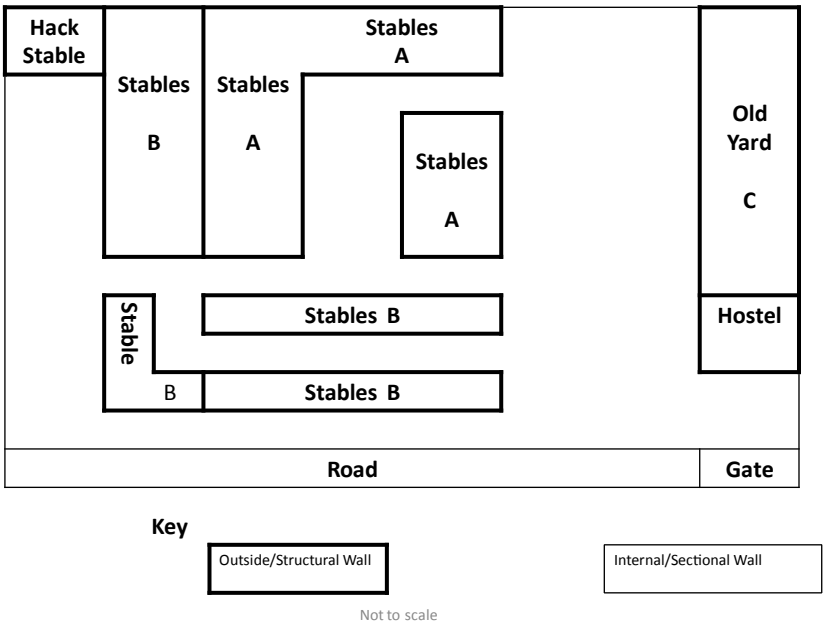


Figure 5.24. [redacted] Yard Plan

5.6.3. Content

[redacted]s made up of three relatively separate yards (Figure 5.24.) located close to the owners/trainers house and the staff hostel which allows for regular horse monitoring and security. The yards are all of different dates, designs and construction, and with differing fixtures and fittings.

5.6.4. Blocks A Construction

The most recent yard, built in 1995 is L shaped with a non-parallel row opposite, constructed of red brick with a tiled roof. Concrete floors are utilised throughout. The stables are divided by red brick internal walls to eaves height. The roof is timber clad.

Dark painted stable doors match the PVC rain water goods, with the lower doors having metal anti chew sheeting towards the top to prevent damage, and an anti-weave grill fixed. The upper door is timber, with an integral grill to allow light and

ventilation if it is shut. The doors each have a top sliding bolt towards the top and a lower kick over bolt.

There is a glazed window to the front which is protected by a metal grill, and a small, narrow ventilation opening within the back wall. The window is largely overlapped by the top door of the adjoining stable, so does provide additional light into the stable, but the level is limited. Further internal light is provided in each stable by a pendant bulb.

5.6.5. Blocks A Fixtures and Fittings

Internally the stables have a rear corner water manger and a plastic corner manger for feed. Externally each stable has a slate name plate with the occupants name inscribed in chalk, a light switch for each stable and a hook for holding the headcollar.

At the end of the yard closest to the house is a weighbridge to allow for regular weighing and monitoring of the horses, a tool storage area and muck heap.

5.6.6. Blocks B Construction

A further red brick yard with a slate roof is designed with two rows of stables facing each other, an adjoining short row forming the second side of a rectangle, and a further row behind, with a separate hack stable opposite that row (Figure 5.25.).

Externally the yard is similar to that previously described, except that the windows to the front of the yard are solid metal to the lower half with wide vertical ventilation slits, and a glazed upper half protected by a metal grill, the glazed section being of a traditional design, hinged between the upper and lower half, allowing the upper half to tilt inwards at the top and allow ventilation above the horse. There is a sliding ventilation slot to the rear of each stable high on the back wall.

Internally the stables differ; the right hand stables are lined with wood, the lower two thirds having narrow horizontal metal strips at approximately brick intervals painted black, and the top third without the metal strips painted white, with a timber clad white painted ceiling.

The left hand stables partition walls have brick bases and timber divisions above, but similar fixtures and fittings to the stables on the right hand side. The single row

follows this design, with a single hack stable being of a unique design; red brick walls and a pitched roof, with no windows.

Between these yards and the original yard on site are a network of neatly hedged walkways and a horse walker.

5.6.7. Blocks B Fixtures and Fittings

Tie rings for securing the horse and/or a haynet are the only fixtures and fittings.

5.6.8. Blocks C Construction

The original stable block is a two storey building containing a single row of red brick stables with accommodation and hay loft above, concrete floors and a slate roof. The block is divided half way down by an elaborate clock tower (Figure 5.26.), the ground floor being a tack storage area with stairs to the first floor and a shoot from the first floor historically for moving feed etc to the ground floor. The tower has ornate stone work around the entrance, large wooden doors front and back and stained glass in the windows. The building is topped with a spire and clock tower.

The stables to both sides of the tower are largely identical, the only difference being that the stables closest to the gateway have permanent black rubber floor mats whereas the stables in the lower half of the yard have removable green rubber floor mats.

Each stable has an original, single piece timber door (Figure 5.27.); with an integral opening and anti-weave grill in the upper section. There is an integral timber upper half door which can be closed to prevent bad weather entering the stable. The door has two bolts, an upper bolt and a lower bolt, and an original restored circular brass lock.

Externally the doors have a metal section below the opening to prevent chew damage. Internally, the doors have narrow metal strips to prevent chewing.

Above each door is a white painted timber framed window hinged at the base and opening inwards at the top to prevent the horse standing in a draft. At the rear of each stable is a similar, arched window.

Internally the lower section of the walls are timber, lined with metal anti chew strips which is painted black, with white plaster above. The ceiling is timber boarded and painted white.

There is evidence of original personnel doors to the front of the dividing walls, but these are now secured shut and not utilised.

Outside the stables is a chequered concrete walkway to allow drainage into a shallow drainage gully running the full length of the stables level with the end of the overhang.

5.6.9. Blocks C Fixtures and Fittings

Each stable has a rounded corner manger in a rear corner, and a triangular corner manger to the front, original tie rings and name plates, plus a single pendant light.

5.6.10. Critical Appraisal

Three separate yards demonstrate different acceptances of stabling over time. The original stables (C) being two storeys high and exhibiting space within the stables and ornate fixtures and fittings, adjacent to which is now the staff hostel and close to the main trainers' house.

The newer stables (A and B) have been constructed to blend in with existing buildings on site. The stables include modern additions such as corner mangers and the doors provide integral anti-weave grills, separate complete top doorway grills and traditional timber top doors. The light is provided by an unprotected ceiling pendant. The importance of ventilation is shown with the use of a window to the front and also a rear ventilation opening.

Some of the older stables (C) have metal anti chew strips horizontally along internal wood lined walls to reduce wood chewing which have not been noted at any other site. These stables also have different windows, being metal with ventilation slits in the lower section and having a glazed upper section, with internal protection grill.

The original building has significantly larger stables than the other yards, and the eaves height is considerably greater, providing light and airy stables, additional light and ventilation being provided by front and rear windows. The internal lined walls have metal anti-chew strips as do the unusual full height stable doors with integral anti-weave grills, and a separate upper door. The original locks have been

renovated and are still in use today, but in addition to newer bolts. These stables are the only stables on site with rubber floor mats and also an overhang offering weather protection.

The site demonstrates both two storey and single storey buildings of differing ages, showing changes in common practice and the move away from having upper floor accommodation and hay lofts to single storey buildings instead (Glendinning and Wade, 2008 and English Heritage, 2006). The older stables show elaborate design features, whereas the more recent stabling are more conservative but not lacking in necessary provision.



Figure 5.25. Pictorial view of Back Yard With Hack Stable

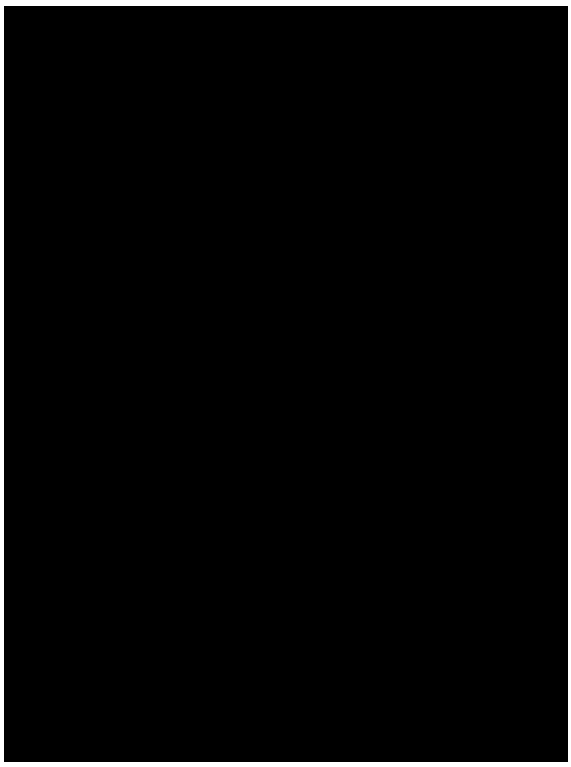


Figure 5.26. Pictorial view of Original Yard with Clock Tower



Figure 5.27. Pictorial view of Original Yard Stable Door

5.7. [redacted]

5.7.1. Introduction and Location

[redacted]



Figure 5.28. [redacted] Location Map

[redacted]

5.7.2. Context

[redacted]

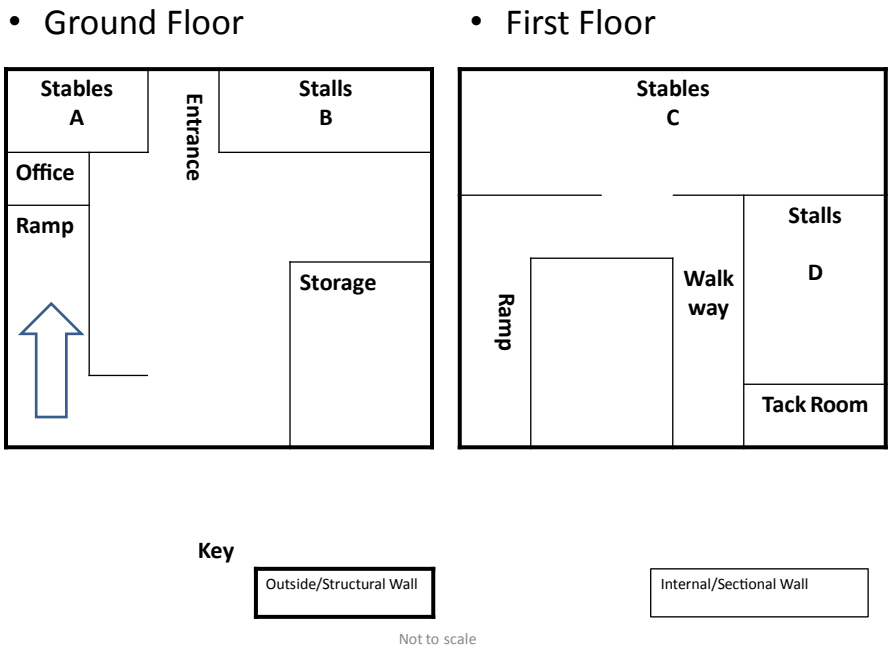


Figure 5.29. [redacted] Yard Plan

5.7.3. Content

[redacted]

5.7.4. Construction

The building extends over four floors and is built of stone and red brick, with ornate stone work and oeil-de-boeuf windows on the first floor, where the majority of the horses are stabled, a slate roof and concrete floor. A wide rubber covered concrete ramp allows personnel and horse access to the 1st floor stables. The building is accessed via an archway with a roller shutter door into a central ground floor courtyard (Figure 5.30.).

The whole courtyard area is roofed above first floor level with a glass roof, allowing natural light into the yard area. Due to the lack of windows and alternative ventilation within the site, the stabling on both levels benefit from an artificial ventilation system which circulates the air regularly.

The courtyard provides access to a feed room, tack room, and hay and bedding storage area, and an area for horses to be tied up securely for farriery visits or veterinary treatment. The area also provides storage for the large wheelie bin which is positioned underneath a shoot, which enables waste to be removed easily from the 1st floor. Leading off the central courtyard is a three meter wide rubber covered ramp with a solid timber and metal banister leading to the first floor stabling (Figure 5.32.).

On the first floor is a tack room for the horses stabled on this floor. There is also a lift to the ground floor for easy transportation of bedding and hay, and also a hatch with a secured top to allow waste to be tipped directly into a waste bin on the ground floor below.

5.7.5. Stables A Construction

Ground floor stabling consists of two stables to one side of the access archway, constructed from sectional lower timber and upper metal grills with sliding doors to allow access within a restricted area. The sliding doors have a removable integral anti-weave grill, which in both cases was open. The stables have windows to the rear, which do not open due to being directly onto the street. Ventilation is provided via an extensive ventilation system which operates throughout the whole building.

Drainage occurs via the stable door into a metal grill drainage system.

5.7.6. Stables A Fixtures and Fittings

Each stable has an automatic waterer and tie ring.

5.7.7. Stalls B Construction

To the opposite side of the main archway is a stall area, providing two rows of stalls, positioned either side of a walkway. The stalls are constructed of sectional timber divisions, with a wide metal grill at the top to allow the horses to view each other, but with a solid timber section at the head of the stall to allow the horses a degree of privacy (Figure 5.31.). Tall windows to the front of the building provide light, but these are not opened due to being adjacent to a busy street. Ventilation is provided via the integral ventilation system.

The stalls floors are black rubber covered, with a drainage gully to the rear.

One of the stalls has a solarium to allow wet horses to be dried quickly without getting cold.

5.7.8. Stalls B Fixtures and Fittings

Each stall has a corner manger and automatic waterer set onto a corner pedestal, a haynet ring and a central retracting tie mechanism to prevent the occupant becoming caught in a trailing lead rope.

5.7.9. Stables C Construction

The first floor has two separate accommodation areas. An area to the front of the building accommodates horses in two rows of stables which face each other (Figure 5.33.). The sectional stables are constructed with front walls and divisional walls made of timber with metal bars above, with concrete floors.

The doors are sliding, to make the most of the narrow corridor, with each door having an integral removable anti-weave grill.

There are oeil-de-boeuf windows to the front of the building providing ventilation. An integral ventilation system provides additional ventilation.

Drainage channels run along the front of each row of stables, and via a drainage system to the ground floor.

The stabling area has two wooden horse chest height access doors to secure any loose horses.

5.7.10. Stables C Fixtures and Fittings

Each stable has a hook outside for the horses headcollar, though uniquely at this site the head collars are left on the horses at night, in case of fire and the need to evacuate the building quickly. The stables have automatic waterers.

5.7.11. Stalls D Construction

The first floor also has a stall area (Figure 5.34.), which at the time of the study was redundant, but immanent use was expected. The stalls area exhibits examples of original stalls, believed to date from the early 1900's.

The stalls face a solid wall with a walkway behind.

The stall divisions are constructed of ornate metal rear pillars with a level horizontal timber rubber covered middle section. The stall division is topped with a metal grill section, higher at the wall/head end of the stall, and curving downwards towards the rear of the stall. Each stall end pillar and metal division contains a timber extension pole which traditionally at night would have been extended across the rear walkway of the stalls and hooks onto a rail in the rear wall, thus securing loose horses (Figure 5.35.).

There are no windows in the stalls area. Ventilation is provided by the integral ventilation system and light is provided by fluorescent strip lights.

Drainage is provided by an open drainage gully behind the stalls, with drains into a central drainage system.

5.7.12. Stalls D Fixtures and Fittings

Each stall has a corner manger and automatic waterer, and a retracting rope tie devise as in the stalls on the ground floor.

5.7.13. Critical Appraisal

Access to the yard is restricted to a single archway with roller shutter door onto a busy street. There is no alternative access or exit for horses or staff, which brings into question the safety of the building in the event of a fire or similar.

The site is unique in that the horses wear headcollars at night in case of the need to evacuate the building, but due to this site having no outside space at all it has to be

questioned how a single security guard would practically evacuate the horses effectively, and where they would be safely evacuated to.

The ground floor stables and stalls have windows, but these are not opened due to being adjacent to a busy street, though providing light provision. Artificial ventilation is provided via the integral ventilation system, and additional light via strip lights.

The stalls have modern fixtures and fittings; automatic waterers, corner mangers and rubber flooring to aid ease of management, and retracting tie facilities to prevent a horse becoming tangled in a trailing leadrope.

The ramp walkway between the floors is wide, shallow and black rubber covered to provide a safe footing and has a high solid banister to ensure the horses safety whilst negotiating it. This is one of two study sites where a ramp is utilised allowing horses to enter first floor stabling, but the only site where the ramp is internal, and is built around a corner, rather than being straight.

The stabling on the first floor has oeil-de-boeuf windows which are opened to provide ventilation, and makes use of sliding doors within a narrow corridor space, rather than traditional stable doors which would block the corridor when any door was opened. Wooden doors shut at night prevent loose horses leaving the stabling area.

The stall area being redundant demonstrates the current practice of utilising stables over stalls where possible. The stalls area has no natural light bar that from the central courtyard and no window or other ventilation, raising concerns over the ventilation levels. The stalls demonstrate feeding and water provision by manger and retractable tie systems as in the ground floor stalls, but also the use of a retracting stall pole, which was unique to this site and reflects the age of the stalls (Powell, 1991).

A drainage system on the first floor feeds directly into the ground floor drainage system, and a first floor hatch system allows for manure to be tipped directly into a wheelie bin below to reduce labour.

It was stated during the site visit that it was expected that the redundant stall area would be utilised to house additional horses moving onto the site. This would unfortunately result in these horses having limited sunlight and ventilation as the only natural light would be via the central atrium of the building.



Figure 5.30. Pictorial view of Entrance

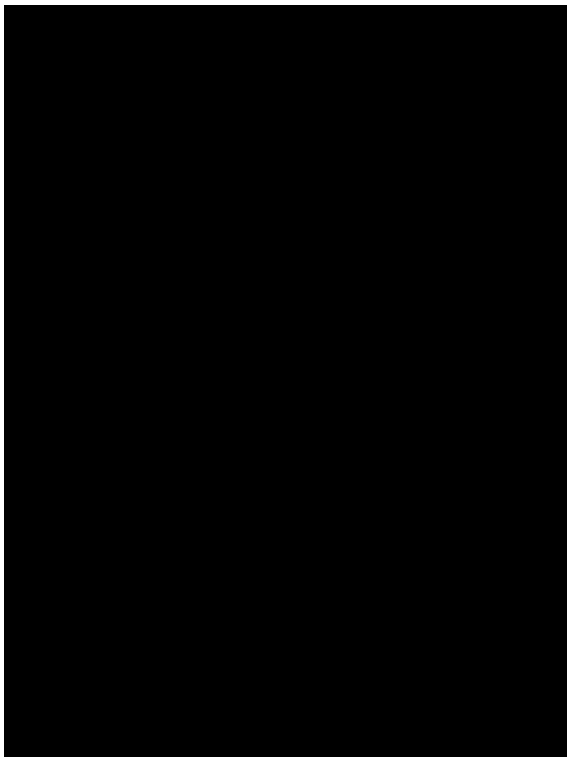


Figure 5.31. Pictorial view of Ground Floor Stalls



Figure 5.32. Pictorial view of Ramp



Figure 5.33. Pictorial view of 1st Floor Stables



Figure 5.34. Pictorial view of 1st Floor Stalls



Figure 5.35. Pictorial view of Stall Posts with Extension

5.8. [redacted]

5.8.1. Introduction and Location

[redacted]



Figure 5.36. [redacted] Location Map

[redacted]

5.8.2. Context

[redacted]

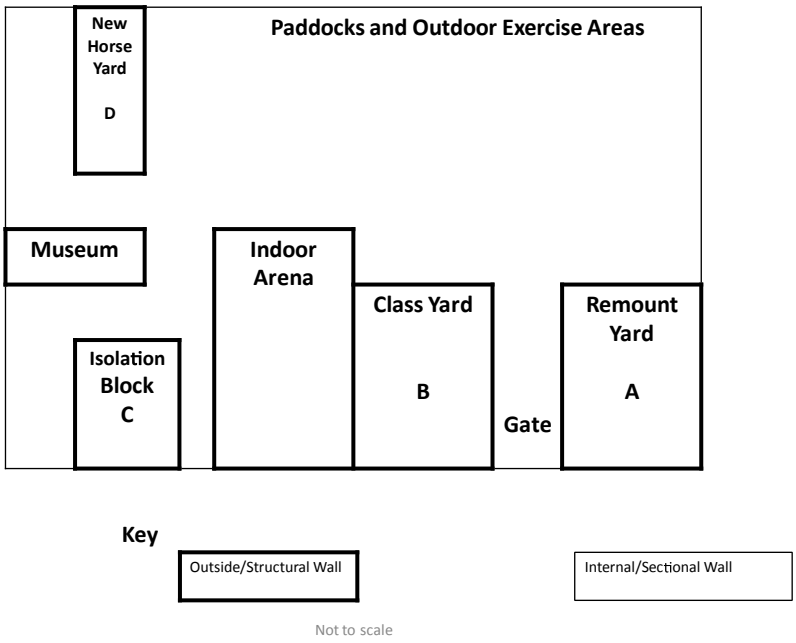


Figure 5.37. [redacted] Yard Plan

5.8.3. Content

[redacted]

5.8.4. Blocks A and B Construction

[redacted]

Internally both blocks have a central passageway, with the [redacted] (Figure 5.40.) having a mixture of stalls and stables on each side of the central corridor and

[redacted] requires both stables and stalls as once the occupants are posted to an operational base, the horses must be used to both facilities depending on availability.

Sectional internal partitioning divides the stalls and stables, with a lower timber section and metal grill upper section. The front sections are identical to the divisional walls.

The stable doors are of identical structure to the partitioning, with the upper section of the door having a V to allow the horse to place its head and neck over the door. The doors are secured by a lower kick bolt and an upper sliding bolt. The stalls do not have a permanent door but a timber gate and chain construction to allow the horse to get use to being confined without a solid door behind them (Figure 5.41.).

Each block is accessed by a wide traditional stable door approximately half way along the length of the building. Windows are positioned at regular intervals along the external walls of the blocks with traditional glazed stable windows. Fans are also positioned along the roof above the central walkway to increase air circulation and ventilation throughout the buildings.

Drainage occurs via a shallow gully with a metal grill running the full length of the buildings in front of the stables/stalls.

5.8.5. Blocks A and B Fixtures and Fittings

Automatic waterers are utilised throughout, as are swivel feed mangers, positioned in the front walls of the stables to allow the horse to be fed from outside the stable. Rug racks are placed at regular intervals to allow rugs to be easily accessible.

5.8.6. Block C Construction

An isolation block (Figure 5.42.) is positioned away from the Remount and Class yards, accommodating horses which are returned from active service because they are sick or injured. The building is constructed of block with a tiled roof and has PVC rain water goods.

The block is square and designed so that the occupants have direct access outside, each stable having a traditional half door with the top door tied back to allow

ventilation. The lower door is secured with a sliding bolt to the top and a lower kick over bolt.

Above each door is a narrow glazed window, and to the side a further gazed window, with the top half opening in the traditional manner.

Outside the stables the concrete block floor slopes to a drainage gully with metal grill which runs around the building. PVC rainwater goods drain straight onto the yard above a drainage grill.

This block is adjacent to the staff accommodation block, allowing for staff to have easy access to sick or injured horses which require constant care and attention.

5.8.7. Block C Fixtures and Fittings

Corner mangers and automatic waterers are utilised within each stable. Outside each stable, by the door are rings and racks for headcollars and rugs, and also folding saddle racks to prevent the saddle being placed on the floor and damaged.

5.8.8. Block D Construction

Due to the relatively large number of horses which enter the yard to begin their career, a separate yard is utilised by the new horses which arrive, usually in batches. These horses remain separate until they have reached a certain point in their training and are accepted by the Metropolitan Police and are then moved into the remount yard. The stables utilised for the horses undertaking initial assessment and training are modern timber sectional stables.

5.8.9. Block D Fixtures and Fittings

The stables have internal tie rings.

5.8.10. Critical Appraisal

Stabling and stalls are utilised to ensure that horses which move, following training to sites with only stalls are used to living in the confined space of a stall. The use of stables where possible exhibits the management preference for using stables over stalls (Brock, 1937., Powell, 1991., and Worsley, 2004.).

Narrow central corridors in the class and remount yards are easily restricted by the stable doors and this may inhibit emergency evacuation. Sliding doors would have reduced such restrictions.

All buildings have adequate windows to provide light and ventilation. Ventilation is further enhanced by the use of roof fans throughout the buildings, to take the air up and over the horses backs and thus to reduce drafts.

A separate isolation block allows sick horses to be kept separately from the other yards thus reducing the risk of disease and contamination transfer. The close proximity to staff accommodation allows ease of care. The separate yard for new inmates enables these horses to remain separate until their health status has been established.

Separate feed and tack rooms on each yard allow ease of management and also maintain equipment in separate areas to reduce the disease risk further.

The site provides paddock turnout facilities for recuperation and exercise and additional indoor and outdoor exercise areas.



Figure 5.38. Pictorial view of Class Building



Figure 5.39. Pictorial view of [redacted] Building

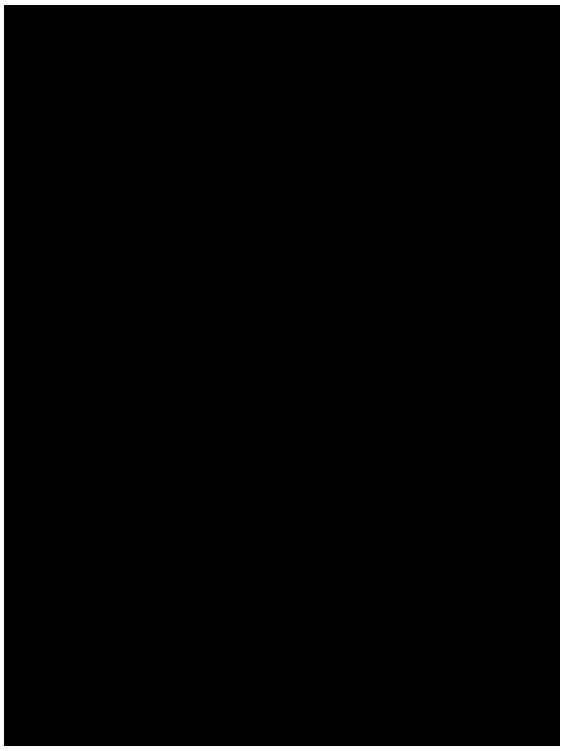


Figure 5.40. Pictorial view of [redacted] Stables



Figure 5.41. Pictorial view of Stall Gates



Figure 5.42. Pictorial view of Isolation Stables

5.9. [redacted]

5.9.1. Introduction and Location

[redacted]



Figure 5.43. [redacted] Location Map

[redacted]

5.9.2. Context

[redacted]

[redacted]

[redacted]

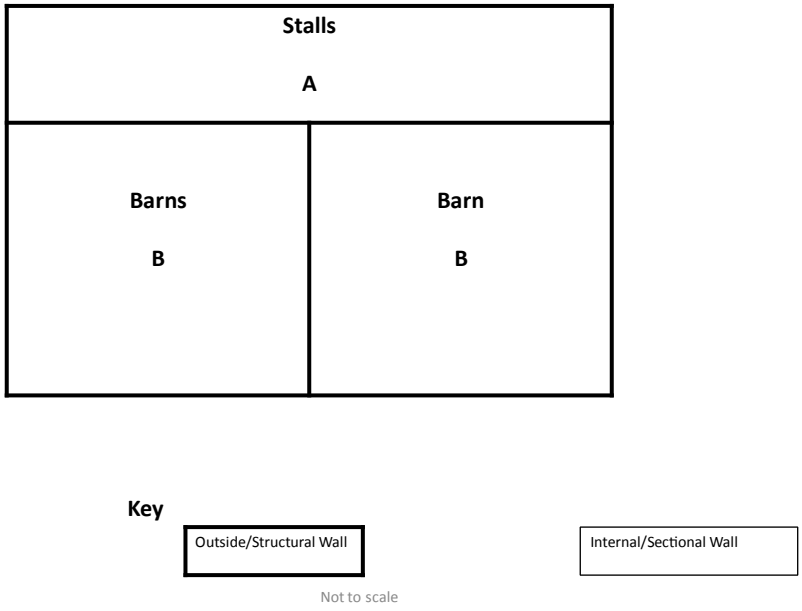


Figure 5.44. [redacted] Yard Plan

5.9.3. Content

[redacted]

5.9.4. Block A Construction

The original purpose built stall block dates from 1935, being constructed of block with a sheet roof, exposed internal timber roof trusses and beams, and concrete floor.

Stalls run along one side of the building, with a passageway behind (Figure 5.45.). Each stall has a block dividing wall with a horizontal wall section towards the rear of the stall, which then slopes upwards at the head end of the stall and slots into the timber hayrack which run the full length of the stalls. Along the top rail of the hayrack is a space for a name plate allowing for easy identification of the occupant.

Behind the row of stalls is a passageway with three doorways allowing horse and personnel access to and from the building. There are no windows or other ventilation within the building, except the doorways mentioned above.

There is no apparent water provision within the stalls.

The passageway has a shallow drainage channel running down the centre to provide drainage. Along the rear wall, are timber harness brackets to allow ease of harness storage for the occupant of each stall.

5.9.5. Block A Fixtures and Fittings

Each stall has a block manger the full width of the stall under a timber hayrack which runs continually the full length of the stalls. Each stall has a central tie ring above the manger.

5.9.6. Blocks B Construction

Alongside the stalls building are two identical modern block and sheet barns, with Yorkshire boarding towards the top of the walls to provide additional ventilation.

Both of these barns contain internal identical stabling constructed from solid metal gates providing accommodation for eight horses in each barn, four stables along each side with a central passageway (Figure 5.46.).

Each stable is constructed of three solid metal gates making two sides and the front of the stable, with the block barn wall forming the rear of the stable. The gates are attached to metal posts at each end with either hinges to secure the gates or bolts to allow the gates to be opened and closed.

No drainage is apparent.

5.9.7. Fixtures and Fittings

Each stable has a metal hay rack, an automatic waterer and a tie ring close to the hay rack to allow the occupant to be secured.

5.9.8. Critical Appraisal

[redacted] exhibits two clearly different stabling provisions, traditional stalls and a modern barn stabling system. This can be accounted for due to the change in the use of the horse on this particular site, though the breed of the [redacted] has not changed, the focus of these particular horses has moved from working agricultural to maintaining and preserving the breed via education and a specific breeding programme.

The stalling provision provides spacious stall accommodation but there is limited natural light via the narrow doorways and total lack of window provision. The hayrack provides a method to feed forage and a manger provides a method to feed concentrate feed, but there is no obvious water provision. This could indicate that the working horses were taken to water to drink at regular intervals and not provided with a constant supply as would be expected today. The tie ring demonstrates the horses were tied, and indicates that they were tied by a simple rope as no retracting tie system is evident.

The stable accommodation provides a greater level of both light and ventilation than the stalls due to the Yorkshire boarding present. The presence of automatic waterers indicates the appreciation of labour saving fixtures as does the use of metal hay racks rather than haynets being utilised. Feed is provided in rubber buckets which are removed immediately after the feed has been eaten, and not left in a manger as in the stalls area. The use of the stables in preference to the stalls indicated the common understanding management preference of stables over stalls (Brock, 1937., Powell, 1991., Worsley, 2004.).

Though labour saving when compared to the use of hay nets, the site is one of only a few within the sites studied which utilises metal hay racks, a fixture and fitting without positive use with regard to modern management practices due to the dangers of the horse injuring itself or getting hay debris in its eyes (Winter, 1846 and Harris, 1999).



Figure 5.45. Pictorial view of Stalls



Figure 5.46. Pictorial view of Stables

5.10. [redacted]

5.10.1. Introduction and Location

[redacted]



Figure 5.47. [redacted] Location Map

[redacted]

5.10.2. Context

[redacted]

[redacted]

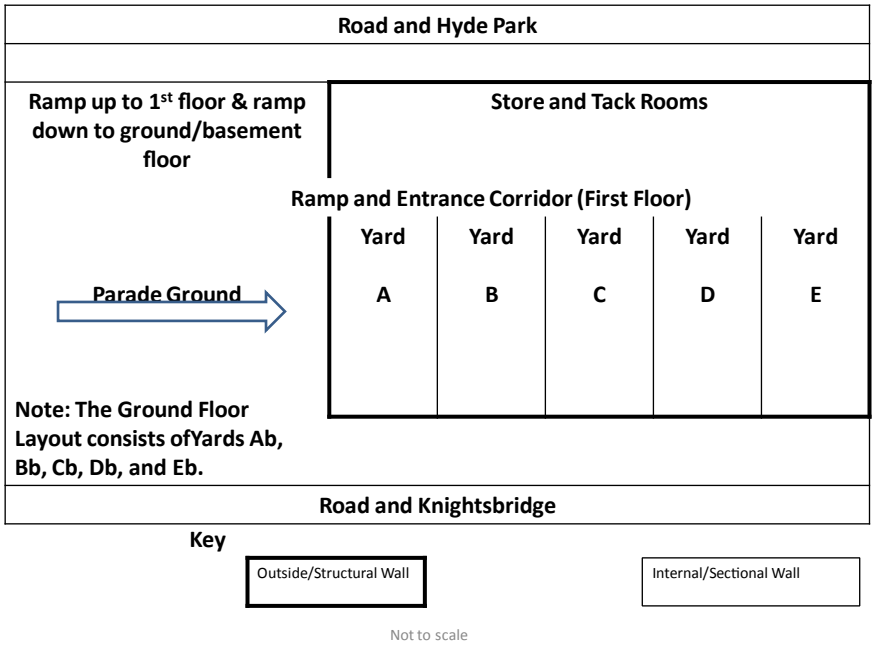


Figure 5.48. [redacted] Yard Plan

5.10.3. Content

[redacted]

5.10.4. Construction

The stabling building is constructed of brick, with a flat felt roof, and concrete floors throughout.

There are five yards on each floor; each being of American Barn design thus stables/stalls facing each other across a central corridor. The yards are entered from the parade ground, the ground floor yards leading off to the right from a corridor and the upper floor yards directly above, leading from a ramp and corridor in an identical fashion to the ground floor yards.

Each yard has its own tack room, feed room and allied storage facilities. All equipment is clearly marked to allow it to be identified, reducing the risk of the equipment becoming mixed up and a yard not having what is required.

The upper floor yards have a muck shoot which allows waste to be passed through a hatch (with clear safety signage and security barriers) to a conveyor belt on the ground floor which takes it to a central waste compactor.

The barracks have on site farriery and veterinary facilities; while on parade the horses will be accompanied by the horse ambulance, a vet and a number of farriers to ensure that should an accident occur, the horse can be treated immediately.

The allied facilities at the site are extensive with an integral indoor school and an [redacted]

5.10.5. Block A Construction

There are double stable doors at each end of the yard, and two metal barred plastic louvred windows at the far end of the yard within the two large stables which each yard has. Additional light is provided via fluorescent strip lighting, and ventilation via an integral ventilation system, which in a number of the yards has additional fans to increase air flow further (Figure 5.49.).

There is an extensive drainage system allowing for stable liquid to flow along drainage gullies in front of the stables/stalls, and into a piped drainage system, collecting waste from both the first and the ground floors.

[redacted]

(Figure 5.50.).

The stalls are constructed around a metal frame which consists of metal rails which runs under the roof beams the full length of the stalls, vertical metal pillars running from the frame to form the rear pillar of the stalls which the timber partitioning panels are attached to. Timber partitions are fixed between the rear pillar and the front wall of the stalls with a quadrant metal grill at the head end to reduce aggressive behaviour between neighbouring horses.

Opposite the original stalls, and forming two rows opposite each other on all the other yards are a row of stables (Figure 5.51.) which can be converted into stalls when required for example when ceremonial duties require significantly more horses than usual to be brought onto the site. These stables/stalls are utilised as stables when the number of horses allow and when horse numbers increase each stable can be converted into two stalls.

The design provides metal and timber sectional panelling to create a front wall and side walls of each stable, the lower portion of both front and dividing walls being timber, with a metal barred section above (Figure 5.52.). The front wall consists of a sliding door which has a timber lower section and an upper grill section, and a front panel which matches the door. When the stable is required for two horses the front panel is released and slid along the metal framework to form a division between two stalls. For this reason when individual stables are utilised each contains two automatic waterers, two fixed mangers and two tie rings, which are all utilised when the stable becomes two stalls.

All the stables were originally designed to have a swing manger which could be swung to the outside and feed deposited within it and then swung back into the stable so that the horse can eat it. These have been removed leaving the hatch secured over the hole in the timberwork and the horses are fed by bucket on the floor which is considered to be a better natural feeding position for the horse.

[redacted]

each of which has a small louvred window (the only windows within the yards). One of the stables is utilised as a stable for either a particularly large horse or one which requires additional space for welfare reasons and the other as a wash down/solarium stable (Figure 5.53.) which horses can be secured within to be washed and then dried under heat lamps.

5.10.6. Block A Fixtures and Fittings

Each stall has an automatic waterer to the side and a central tie ring to which the horse is tied.

5.10.7. Block B Construction

Block B is identical to Block A except that the stables, being located as in Block A are all of the modern design, and thus can be adjusted to accommodate double the number of horses in stalls.

The construction of Blocks C, D and E is identical to Block B.

5.10.8. Block B Fixtures and Fittings

The fixtures and fittings in Block B are identical to those described above in Block A.

The fixtures and fittings in Blocks C, D and E are identical to in Block B.

5.10.9. Blocks Ab, Bb, Cb, Db, and Eb (Ground Floor) Construction

The ground floor blocks are all identical to Block B described above.

5.10.10. Blocks Ab, Bb, Cb, Db, and Eb (Ground Floor) Fixtures and Fittings

The ground floor blocks have identical fixtures and fittings to Block B.

5.10.11. Critical Appraisal

[redacted]

depending on the number of horses which need to be accommodated the sectional stabling/stalling can be altered to suit requirements. This allows the horses to be largely stabled when the horse numbers are reduced and maximise the use of stalls when horse numbers increase and additional accommodation is required.

The site exhibits extensive attention to health and welfare of the occupants regarding onsite farriery, veterinary and saddlery provision and also the removal of wall mounted mangers thus allowing the horse to eat from a bucket on the floor in a natural feeding position, and labour saving devises such as automatic waterers throughout and the use of a muck shoot from the first to the ground floor, but the provision of additional wall mounted fans demonstrates a lack of ventilation provided by the original ventilation system, and a distinct lack of natural light due to very limited window provision throughout the building.

Since the case study site visit Fitzpatrick (2012) reported that a new home is being sought for the barracks, allowing the Regiment to relocate, but only if a suitable alternative site can be found which meets the specific criteria: large enough to locate all the facilities required by the HCMR on site; located within a 4 Km (30 minute ride) of Horseguards parade; having enough space for an on-site indoor school and being no more than 1 Km from outdoor equestrian exercise facilities, exercise area or park land.



Figure 5.49. Pictorial view of Ventilation System



Figure 5.50. Pictorial view of Original Stalls



Figure 5.51. Pictorial view of Stables and Stalls

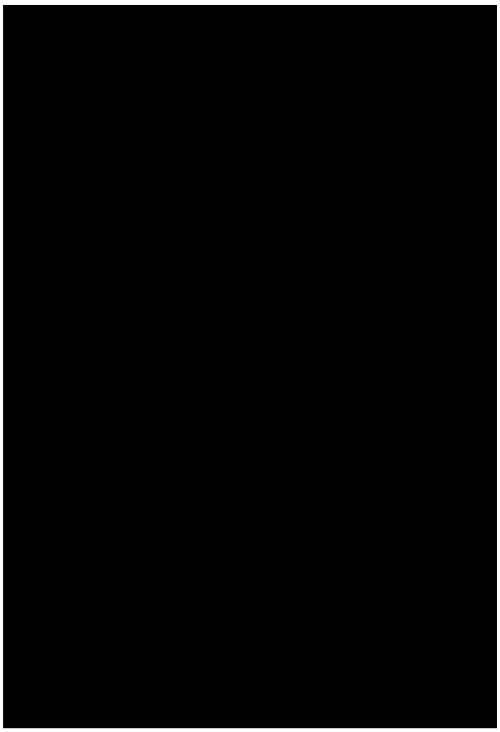


Figure 5.52. Pictorial view of Stables to Stalls Structure

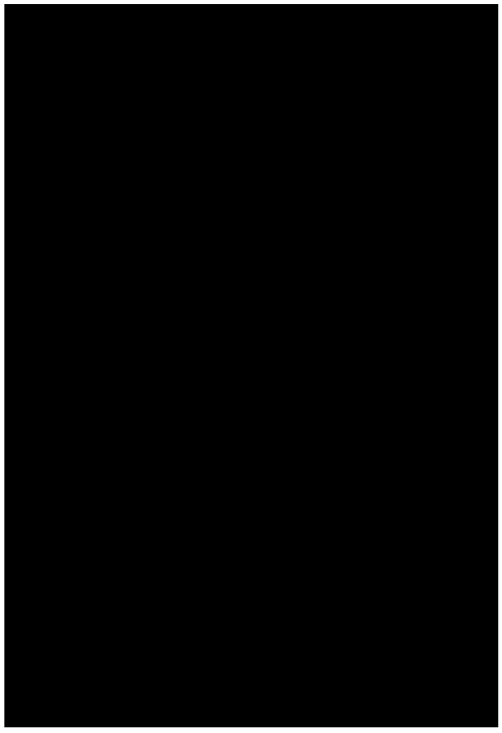


Figure 5.53. Pictorial view of Solarium

5.11. [redacted]

5.11.1. Introduction and Location

[redacted]



Figure 5.54. [redacted] Location Map

[redacted]

5.11.2. Context

[redacted]

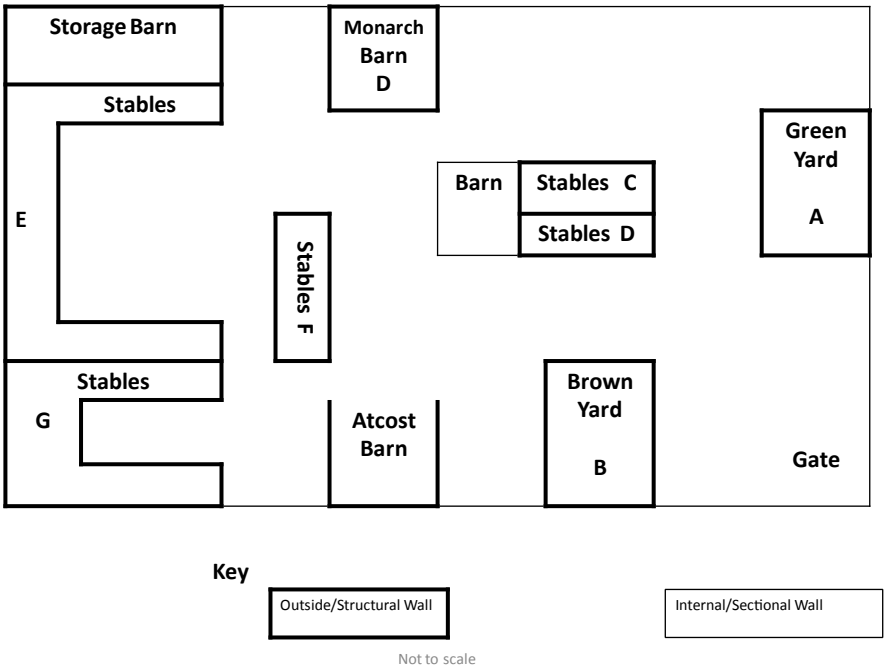


Figure 5.55. [redacted] Yard Plan

5.11.3. Content

[redacted]

5.11.4. Block A Construction

Block A (Green Yard) is a converted beef cattle building constructed of block with Yorkshire boarding above and a sheet roof with skylights at regular intervals. The building contains six pillars in two rows to support the roof trusses. The building has a concrete floor (Figure 5.56.).

At the front and rear of the building are pairs of eaves height sliding doors to allow primary access to the front of the building and emergency access to the rear.

There are no windows within the building, light and ventilation being provided via the front access doors which are usually (except in inclement weather) left open, and the Yorkshire boarding. Additional lighting is provided by fluorescent strip lights.

The building has been utilised to provide stabling for eight horses in two facing rows with a central isle. The stables have been constructed utilising timber sectional stabling with metal bars to the front at half wall height to eaves height. The doors are also half timber (lower half) and half metal bars (upper half) with an anti weave V shape to allow the horse to put its head and neck over the door, but not weave.

The doors have a lower kick bolt to allow easy access without bending down and a small spring bolt three quarters of the way up the door (Figure 5.57.).

Drainage is provided by shallow drainage channels in front of each row of stables which flow directly through the doorway on to the yard outside.

PVC rainwater goods take rainwater directly onto the yard surface, which slopes to yard drains.

5.11.5. Block A Fixtures and Fittings

Within each stable is an automatic waterer and tie ring on the rear wall. Outside is a folding saddle rack.

5.11.6. Block B and Block C Construction

Two stable blocks have been purpose built close to Block A; Block B (Figure 5.58.) and Block C (Figure 5.59.). Each is of a similar construction; steel framed, timber external walls and a clear sheet roof. Both buildings have concrete floors and sliding doors to the front and rear.

Inside the two blocks are very different in design. One has a central walkway with sliding doors to two internal squares, with five stables and eight stables respectively.

Between the stables are dividing walls made up of a mixture of solid timber (lower half) and part metal grill (upper half). Due to the internal design the stables are of a variety of sizes. The second stable block has a central isle with four identical stables facing each other.

Each stable has an external louvred window with an internal metal grill. Further ventilation is supplied to each block by a central roof ventilation duct. Light is provided by strip lighting and mains water is provided at the rear of each yard.

Drainage is supplied via a small central channel which discharges to the outside of the building. PVC rainwater goods discharge directly onto the external yard surface.

5.11.7. Block B and Block C Fixtures and Fittings

Each stable has a high tie ring for a haynet and a lower tie ring for securing the horse, and externally a folding saddle rack. Water is supplied by plastic bucket.

5.11.8. Block D Construction

In contrast to the two purpose built blocks, there is a row of three stables which form part of an original farm building. The three stables are within a block built barn with a sheet roof and concrete floor.

Traditional stable doors provide access whilst at the rear of the stables is a low wall into an internal service corridor. Beyond the corridor each stable has a plastic louvred window in the rear wall providing a degree of light and ventilation.

Drainage is provided via the stable door onto the external yard surface.

Water is supplied by plastic bucket.

5.11.9. Block D Fixtures and Fittings

Each stable has a tie ring and a haynet ring.

5.11.10. Block E, Block F, Block G and Block H Construction

Four further blocks provide stabling for twenty nine horses in a two straight row blocks of four stables (Block E and Block F) (Figure 5.60.), one stable being significantly narrower than the others (Block F) (dictated by yard location), a horse shoe shaped block of twelve stables (Block G) and a horse shoe shaped block of nine stables (Block H).

These stable blocks are all of identical sectional structure; timber with sheet roofs built on a double brick foundation course, with concrete floors.

Each stable has a traditional stable door, with lower kick bolts and sliding top bolts, along with a metal anti-chew panel and metal strip to the top of the lower door. To the front of each stable is a plastic glazed window with metal grill and a traditional opening upper light. A number of the stables have had the plastic glazing removed and replaced with timber boarding thus reducing ventilation and air flow into the stables concerned.

The stables all have an overhang to the front, with an electric strip light in each stable to provide additional lighting.

Water is supplied by plastic bucket. One water tap is located within each yard.

PVC rain water goods are a variety of brown, black and white, and drain onto the yard directly, which has a number of drainage channels and shallow falls into yard drains.

5.11.11. Block E, Block F, Block G and Block H Fixtures and Fittings

Each stable has a tie ring and a haynet ring, and externally a folding saddle rack.

5.11.12. Critical Appraisal

[redacted] demonstrates a variety of stabling, both stables within existing farm buildings and purpose built timber sectional stabling. Generally the stabling provision demonstrates economic practicality, without elaborate design features or fixtures and fittings.

Green yard has front and rear sliding doors to provide access, though the rear doors are blocked by the storage of pallet loads of bedding, thus preventing emergency evacuation via this route. The spring door bolts are small and difficult to open, especially when gloves were worn, and would be practically impossible to open in the heat of a fire.

The two purpose built blocks having clear sheet roofs and have proven to be excessively hot in the summer, even with the ventilation provision of both windows and roof ventilation ducts.

The foaling box within the original farm building allows for a brood mare to be accommodated for educational purposes, the sectional stabling providing a narrow stable for a smaller horse or one requiring restricted room for veterinary reasons and

also a number of larger corner stables thus allowing for larger horses to be accommodated in the larger stables.

All the sectional stables have an overhang; therefore staff working on the yard can work along the overhang or within the internal yards and be thus relatively protected and sheltered during poor weather.

A number of the sectional stables have had the plastic window glazing removed and replaced by timber boarding, thus minimising both natural light and ventilation into these stables.

The allied buildings produce a relatively large footfall for staff working around the yard with only a single bedding store, feed store and tack room. This yard provides specific purpose built hay bale soaking tanks which have been specifically designed and built and are in constant use as all hay fed is pre-soaked and not fed to any of the horses in a dry state, demonstrating the importance of a minimum dust environment.

On a practical yet negative point, surprisingly for a professional educational establishment there are no obvious fire evacuation notices displayed, or emergency contact details. Staff do live close to the yard, but with a public footpath running through the yard this may be useful to allow members of the public to contact relevant personal quickly in the event of them discovering an emergency.



Figure 5.56. Pictorial view of Green Yard Inside



Figure 5.57. Pictorial view of Green Yard Door Bolts



Figure 5.58. Pictorial view of Car Park Block



Figure 5.59. Pictorial view of Sheep Shed Block



Figure 5.60. Pictorial view of Wooden Boxes

5.12. [redacted]

5.12.1. Introduction and Location

[redacted]



Figure 5.61. [redacted] Location Map

[redacted]

5.12.2. Context

[redacted]

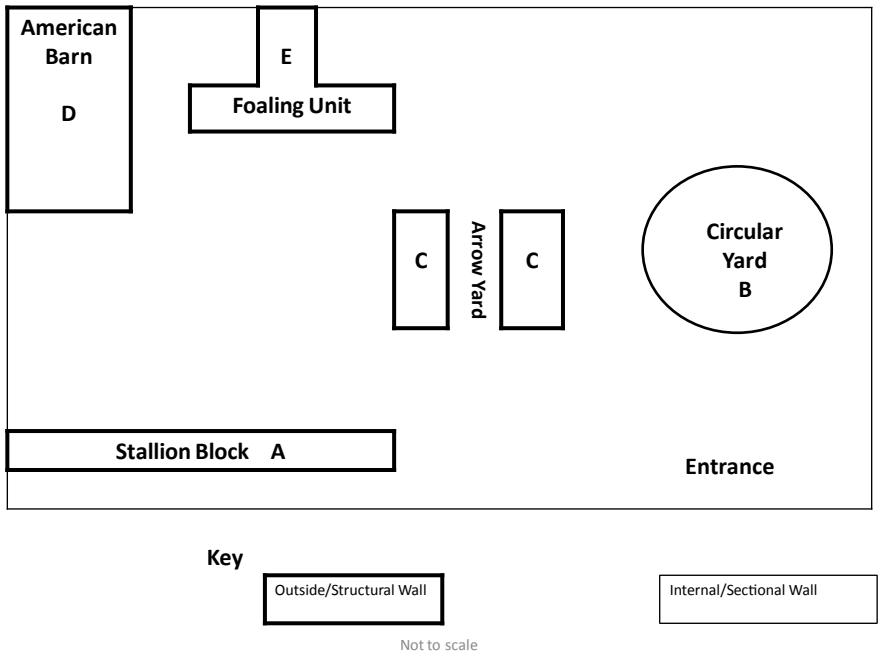


Figure 5.62. [redacted] Yard Plan

5.12.3. Content

[redacted]

5.12.4. Block A Construction

Block A, The stallion block (Figure 5.63.) is distant from the mare and foal yards providing a relatively isolated yard with specific paddocks adjacent to the yard providing easy access. The stallion stables are situated on each side of an elaborate archway and porch with clock tower and weathervane which overhangs the feed store and the tack room which are located on each side of the archway.

Behind the arch is the covering area, where the stallions are introduced to the mares. This is the only location on the stud where the mares (either visiting or resident at the stud) come into contact with the stallion. The covering yard has full height doors to the front and to the rear, allowing mare access from the rear and separate stallion access from the from (stallion yard). The floor is deeply covered in wood chippings, with black rubber applied to the walls to provide added protection.

An enclosed area to the rear of the covering yard is utilised to prepare the mare for covering; with allied equipment storage alongside and a separate stable area for the teaser stallion (pony).

Block A is constructed of block, rendered and painted white externally, with a tiled roof. There are concrete floors throughout, but black rubber covered. Each side of a central archway accommodates five stallions in five similar stables.

The stables have a traditional stable half door to the front with a window alongside, the windows being on the side of the door nearest to the central archway, thus maintaining symmetry throughout the design. The stable doors are substantial timber, painted black and having a solid metal plate on the rear of the lower door to prevent damage, the lower door being topped with a metal anti weave grill. The lower doors are secured by a lower kick bolt and towards the top both a flick over latch and a bolt to provide additional security.

The windows are glazed with eight panels, the lower four set into a static metal frame, and the upper four being hinged at the base and opening inwards in a traditional fashion to allow ventilation. The windows are protected internally by vertical metal bars.

5.12.5. Block A Fixtures and Fittings

Each stallion stable has a hay rack to the front, and a metal corner manger and a corner automatic waterer in the rear corners of the stable. The surrounds of the mangers and waterers vary for stable to stable, being either tiled or having sheet metal surrounding them. There are a number of tie rings along the back wall, one with a chain tie provision. Each stable has an electric light, a thermal lamp bulb and a security camera.

5.12.6. Block B Construction

Block B is a circular building (Figure 5.64.) with a central grassed area, constructed of rendered block with a pantiled roof, and concrete floor. The yard is entered by an archway with a second auxiliary entrance to the side of the yard. The yard has an overhang to the inside providing a covered walkway along the front of the stables. All the stables face inwards onto the concrete walkway and the central grassed area, with the stables being numbered in a clockwise direction from the main entrance.

Each stable has a traditional timber half stable door, with the top door fastened back and a metal grill as an integral part of the lower half door to prevent the mare reaching over it. The doors are fastened with a lower kick bolt and a top flat flick over bolt.

To the side of the door is a metal framed glazed window, the lower half not opening but the upper half hinged at the base and opening inwards at the top. The window is protected by internal metal bars, which appear to have had additional alternate bars added since initial construction. Each stable has a small rear window also.

Due to the shape and the design of the yard the internal rear wall is approximately 1 m longer than the internal front wall.

Internally the stables are rendered to match the external appearance, the internal walls painted, the lower section black and the upper section white.

Stable drainage and PVC rainwater goods drain directly onto the yard surface, and subsequently onto the central grass area.

5.12.7. Block B Fixtures and Fittings

At the rear of each stable, the full length of the rear wall has a solid manger/trough and automatic waterer system with integral plumbing (Figure 5.65.). The brick built, rendered trough system which stands at approximately 1m high consists of an integral metal manger/trough, an integral metal automatic filling water trough and a metal plate covered section containing the plumbing for the system.

5.12.8. Block C Construction

Block/yard C is designed in the form of an arrow shape (Figure 5.66.), being two rows of stables which face each other at an offset angle across a divisional grass area. The buildings are white rendered with red tiled roofs, as the previously described circular yards.

Though externally the stables are of an identical construction to the previous yard, and the stable doors and windows are identical also, the internal fixtures and fittings are different.

In addition to the features described above, the stables have rear doors leading into a large storage area directly behind and incorporated into the row of stables and thus provide access for stored materials such as bedding and hay.

5.12.8. Block C Fixtures and Fittings

To the front of these stables is a built in metal manger with a similar rear corner manger and a small additional hanging manger. There is no automatic waterer system, therefore either the mangers have to be manually filled to provide water or a simple bucket system utilised.

5.12.9. Block D Construction

Block D is an American Barn (Figure 5.67.) stabling complex which has in the past been utilised for external parties to stable horses due to its location away from the centre of the business and also away for the visitor tour route.

The American Barn is a concrete frame, block built structure which has been rendered and painted white to match the other buildings on the site. The building has a sheet roof, concrete floor and large double sliding doors at each end of the building.

Internally there is a clear division of use within the building, the first section containing stabling and the second being an open plan storage area towards the rear of the building.

The stabling area is divided into two rows of stables which face each other across a central corridor. Immediately inside the main front doors are a tack room, an office and a medical preparation room. The stables continue down the building in two rows

constructed of painted blocks, the lower section being black and the upper section being white.

To the front each stable has a full height sliding door which is timber with an inset metal grill in the upper section. The door is secured by a simple flip over latch approximately half way up the height of the door.

To the front of the stable is also a window which is not glazed but utilises metal bars for security. The dividing walls between the stables have a boarded section in the upper half. It appears that this section was originally open with metal bars to prevent the occupants touching each other, but these sections are now boarded up with timber on each side, thus forming a solid divisional wall between the stables.

5.12.10. Block D Fixtures and Fittings

Internally each stable has an automatic waterer, a built in manger and a metal hayrack. A number of the stables have tie rings but not all, thus there is no consistency regarding tie rings.

5.12.11. Block E Construction

Block E is utilised as a foaling unit (Figure 5.68.) situated in a central position within the site designed around an ornate entrance porch with a weathervane depicting a stork carrying a foal. The building is constructed of rendered block with a tiled roof to match the other original buildings on the site. Throughout are black rubber covered concrete floors.

The building is designed with wings on each side of the entrance porch which provides foaling stables facing the front of the building. These stables have an additional door to the rear which leads into a personnel corridor which runs the full length of the wings to provide internal access throughout the building.

Within the main entrance is a sitting up area for staff to observe the mares, providing staff with a comfortable and practical area including kitchens etc: and also allied facilities and equipment for managing the mares and foals. From the rear of the sitting up area is a third wing with a central personnel walkway corridor (Figure 5.69.) and foaling stables on each side which have personnel access directly from the corridor at the rear of the stables and main stable doors which open from the front of the stables.

The stables are all of similar design with a front stable door and window identical to those utilised elsewhere on the stud (except within the American Barn complex). The stables all have sliding internal personnel doors due to the narrow corridors that they open into. A number of the doors have peep holes, so that the mares can be observed without disturbance, set into the top half of the door which is glazed with strengthened glass. A number of the doors, especially the ones within the front wings of the yard have small wooden doors which cover the peep holes and can be opened to allow the mare to be viewed. The doors have a variety of circular latch handles and also simple straight latch handles.

5.12.11. Block E Fixtures and Fittings

Internally the stables have black rubber covered floors and minimal fixtures and fittings, simply two metal corner mangers which are boxed in with sheet metal to prevent injury. Each stable also contains a heat lamp to provide additional heat as required. It should be noted that the foaling season for the Thoroughbred horse in the Northern Hemisphere is officially from the 1st of January and thus the weather can be significantly inclement.

5.12.12 Critical Appraisal

[redacted]

horse, providing specifically designed stabling and extensive pasture for mares and foals and also resident stallions.

The stallion yard provides purpose built accommodation that demonstrates the requirement for large stables, with greater substantiation in terms of stable doors and metal plating to doors and walls to prevent damage by the occupants. The use of security cameras demonstrates the financial value of the stallions stabled within.

The site utilises extensive landscaping and the use of near identically constructed buildings to produce an aesthetically pleasing and practical setting.

The circular yard demonstrates design interest resulting in stables with a longer rear wall than front wall, which was not seen elsewhere within the study. These stables also had the labour saving addition of integral mangers and automatic waterers with integral plumbing, not seen elsewhere. The addition of further metal bars on the windows may demonstrate that the original bar spacing was deemed too great and

additional bars added to prevent the possibility of a mare catching a hoof between the bars.

The arrow shaped yard doesn't have labour saving automatic waterers, therefore either the mangers were manually filled or buckets were utilised.

The American barn lacks both natural light and ventilation, further exacerbated by the timber boarding covering the original metal grills, which allowed limited communication between neighbours.

The foaling unit provides a purpose built facility to cater for permanent and temporary mares at the stud, some who arrive just to foal within a specialist facility. The building design with internal passageways, the use of front and rear doors in each stable and extensive allied personnel areas demonstrate the labour intensive and specialist role of this yard unit.

The site use was unique within the case study sites in that the primary use of the site was the breeding industry and also that such a large facility in terms of land hectarage was incorporated, demonstrating the importance of both specific stable yards and pasture turn out exercise paddocks. The stables have been designed with practical horse use in mind and also consideration for the needs of the staff, thus producing an aesthetically pleasing and practical facility.



Figure 5.63. Pictorial view of Stallion Unit



Figure 5.64. Pictorial view of Circular Yard



Figure 5.65. Pictorial view of Circular Yard Trough & Manger



Figure 5.66. Pictorial view of Arrow Shaped Yard



Figure 5.67. Pictorial view of American Barn



Figure 5.68. Pictorial view of Foaling Unit



Figure 5.69. Pictorial view of Foaling Unit Internal Corridors

5.13. [redacted]

5.13.1. Introduction and Location

[redacted]



Figure 5.70. [redacted] Location Map

[redacted]

5.13.2. Context

[redacted]

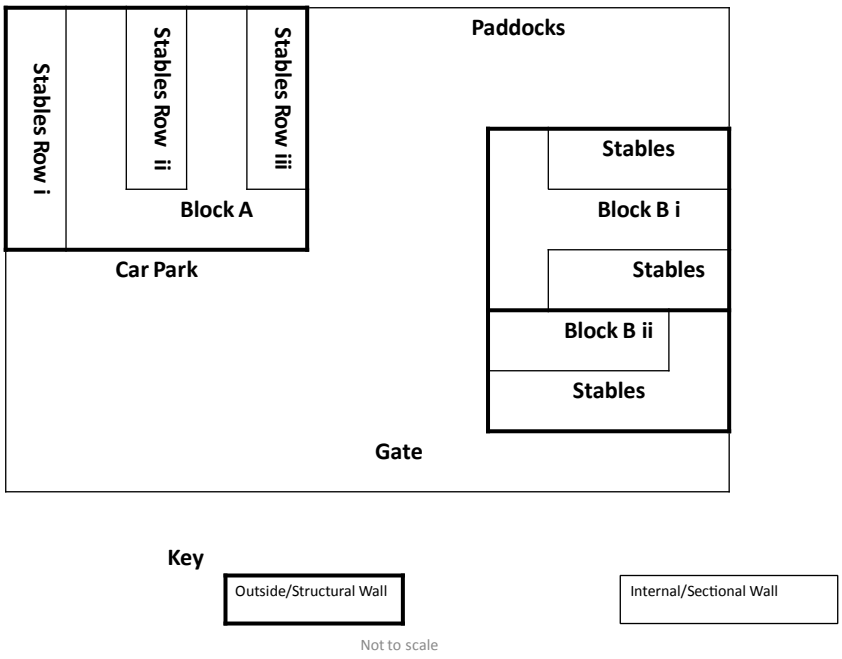


Figure 5.71. [redacted] Yard Plan

5.13.3. Content

[redacted]

5.13.4. Block A Construction

Block A, built in the 1970's as an agricultural building is constructed of a concrete frame, with block and Yorkshire boarding walls and a sheet roof with clear skylight panels and a concrete floor.

The building is accessed by a double width doorway from the front yard, or single width doorway to the rear.

There are no windows in the building, light and ventilation provided by Yorkshire boarding, clear skylights in the roof and fluorescent lighting.

Internal stables (Figure 5.72.) have been designed to fit in between the concrete roof support pillars to provide three rows of stables. Two rows of stables face each other

across a central corridor (rows i and ii) and a third row (iii) faces towards the rear of row (ii).

The stables are constructed of similar materials to the external fabric of the building, being block with red brick edging along the front walls. The divisions between each stable are constructed of block with level horizontal tops and the front walls are of an ornate design which slope from the top of the dividing walls to the level of the central stable door. The front walls have an ornate coping of red bricks which are laid perpendicular to the blocks.

The stables are designed to accommodate a variety of horses, with row i being uniformly smaller in size than row ii, and row iii containing two different sizes of stable to accommodate the larger horses on the yard.

The stable doors are central within the front wall of the stables with each door secured by a lower kick bolt and an upper horse proof bolt.

Water is provided in individual plastic buckets filled from a central yard tap located alongside tack and feed rooms.

Minimal drainage was apparent, only a small gully in front of the stables which drained towards the doorways.

5.13.5. Block A Fixtures and Fittings

The stables contain a variety of fixtures and fittings which have evolved over time and been added to by the relatively transient occupants and include tie rings, hay net rings and mineral lick holders. Each stable does have an identical rug rack on the front wall for rug storage.

5.13.6. Block B Construction

Block B is a concrete frame barn with brick and sheet walls, a sheet roof and concrete floor. The barn is divided into two stabling areas (i and ii) taking into account the position of the concrete roof supports.

The left hand stabling area (i) (Figure 5.73.) has mesh over the top of the large open front to reduce drafts and weather entering the building, whereas the stable area to the right has large full height metal sliding doors.

There are no windows in the end wall of the left hand section or skylights in the roof within this section of the barn. Light is provided by natural light from the doorway and fluorescent strip lighting, ventilation in via the doorway.

The stables within the left hand section form two rows which face each other across a narrow corridor. The stables are constructed of block dividing walls with block and bars to the front and stable doors hinged straight into the metal framework.

The stabling within the right hand section of the barn (Figure 5.74.) are constructed of block dividing walls and block and metal bars to the front which are not level/horizontal with the dividing walls but horizontal for approximately half the length of the front wall and then form a shallow downwards curve to the height of the stable door, which is supported on metal doorposts.

Water provided by plastic buckets filled from a central yard tap.

The stables have been constructed over existing drainage channels which are covered by metal grills. The drainage channels flow to the outside wall of the building.

5.13.7. Block B Fixtures and Fittings

Minimal fixtures and fitting were noted, except tie rings

5.13.8. Critical Appraisal

[redacted] demonstrates creative and practical use of redundant modern farm buildings. The buildings offer varying degrees of both ventilation and natural light with the limited use of skylights and extensive use of Yorkshire boarding, but do not contain any windows. The smaller barn is significantly darker than the larger barn even though the front section is relatively open.

Throughout the barns the internal stabling has been designed around the internal fabric of the buildings thus providing a variety of stable sizes for the varied occupants. The dividing walls are both practical in design to not restrict light and ventilation and also aesthetically pleasing with the sloping front walls using contrasting red brick coping.

The central position of the stable door within the front stable wall is unique to this site, but does allow the horse to look over the door without being able to interfere with its neighbour.

Central tack and feed rooms provide a central meeting point in the yard but does result in a relatively high footfall around the yard. This is the case for water supply also as the larger barn and the smaller barn both have central water supplies to supply the whole yard.

Access to the larger barn is slightly limited due to the doorway configuration, though the smaller barn has a large almost open plan frontage. The barns are situated around a large parking area, providing easy access from the road.

The yard provides a variety of exercise opportunities, the horse walker, the outdoor arena and the paddocks. Local farm tracks provide off road riding for the horses stabled here.



Figure 5.72. Pictorial view of Main Barn Internal Stables



Figure 5.73. Pictorial view of Smaller Barn Left Hand Side



Figure 5.74. Pictorial view of Smaller Barn Right Hand Side

5.14. [redacted]

5.14.1. Introduction and Location

[redacted]



Figure 5.75. [redacted] Location Map

[redacted]

5.14.2. Context

[redacted]

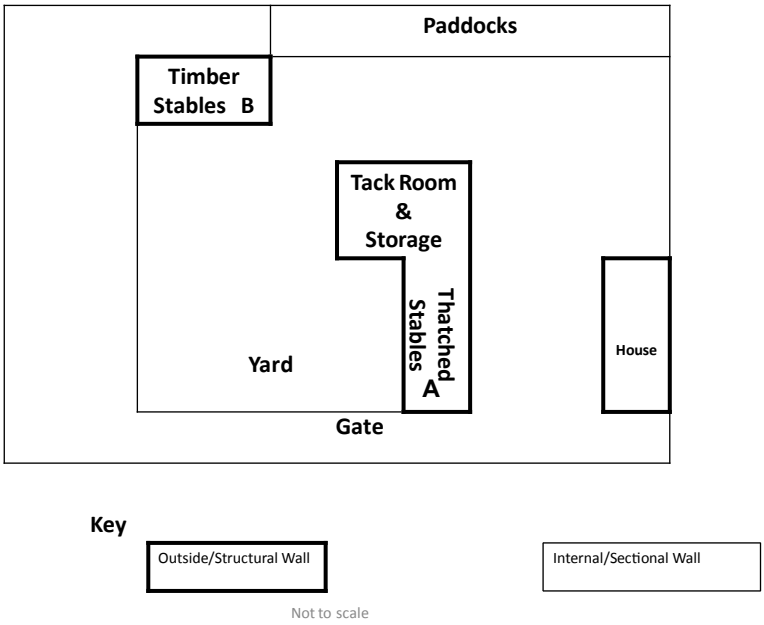


Figure 5.76. [redacted] Yard Plan

5.14.3. Content

[redacted]

5.14.4. Block A Construction

Block A, the thatched stable block (Figure 5.77.) accommodates three horses and is constructed of block which is rendered externally and painted to match the house beyond, with a reed thatched roof and concrete floor. Black rubber matting is used at the front of each stable. There is an overhang to the front of the building supported by timber pillars which are painted black to match the stable doors and detailing on the end walls to match the house. The stable block is a shallow L shape with the left hand range containing tack and feed rooms, with stairs into a loft area which is above two of the three stables.

Each stable has a traditional stable door; the lower section secured by an upper bolt and lower kick over bolt. The upper section is fastened open to aid ventilation. The right hand stable has a glazed plastic louvred metal barred window, but there are no windows to the rear of the building as it backs onto a summer house thus further ventilation is provided via identical windows to the front of the stables which are positioned behind the top half of the stable door, when the top half of the door is fixed open.

The dividing walls (Figure 5.78.) between the stables are constructed of solid horizontally timber rails, utilised to roof eaves height or lower by removing a number of the rails.

Water is provided in plastic buckets from a tap within the feed room area.

Due to the building being thatched, there are no rain water goods. There is no apparent drainage, stable waste draining away through the door and directly onto the external yard.

5.14.5. Block A Fixtures and Fittings

Fixtures and fitting include tie rings and haynet rings. In one stable is a mineral lick holder, but no mineral lick.

5.14.6. Block B Construction

Block B is of modern sectional timber construction with a felt roof, and concrete floor accommodating two horses (Figure 5.79.). Black rubber matting is used at the front of each stable.

The building has been designed to allow as much light and ventilation to enter the stables as possible and also to allow the occupants to look out across different areas of the site.

Both stables have traditional stable doors to the front with the top half of the door fastened back to allow ventilation and a glazed window to the right of the stable door. To the rear each stable has a further stable door (Figure 5.80.) identical to that at the front thus allowing further ventilation and light from the top half of the door and direct access into the paddock behind the stables. The left hand stable also has a window in the left external wall thus increasing ventilation further.

The front section of the concrete floor is covered in black rubber matting.

Drainage from the stables is into central drains across the yard.

Water is supplied in plastic buckets from a single tap in the feed room area.

5.14.7. Block B Fixtures and Fittings

Fixtures and fittings include tie rings and haynet rings.

5.14.8. Critical Appraisal

[redacted]

historic, but on closer inspection is built from modern materials. Due to the use of thatch this stable block doesn't have any rain water goods, but does have necessary fire extinguishing equipment to hand.

The hay loft is not used to store hay or bedding demonstrating the negativity to this practice.

Both stable blocks demonstrate the importance of natural light and ventilation with the extensive use of windows and doorways, the only negative point being when an opened top door is fastened across a window, thus reducing the ventilation and light available.

The use of horizontal timber rails to divide the original stables allows for the division to be constructed to meet the needs of the occupants, thus where possible a lower division is utilised to allow light and ventilation above.

The unique use of stable doors to the front and rear of the newer block allows direct access to the adjoining paddock.

The small muckheap is central within the yard allowing ease of access and is regularly removed therefore not affecting the horse's health negatively.

The yard demonstrates a high level of safety awareness with fire extinguishers in place and the yard being securely fenced from the house driveway, the road and also the garden with unfenced swimming pool.



Figure 5.77. Pictorial view of Thatched Yard



Figure 5.78. Pictorial view of Thatched Yard Stable Divisions



Figure 5.79. Pictorial view of Timber Stables



Figure 5.80. Pictorial view of Timber Stables Showing View into Paddock

5.15. [redacted]

5.15.1. Introduction and Location

[redacted]



Figure 5.81. [redacted] Location Map

[redacted]

5.15.2. Context

[redacted]

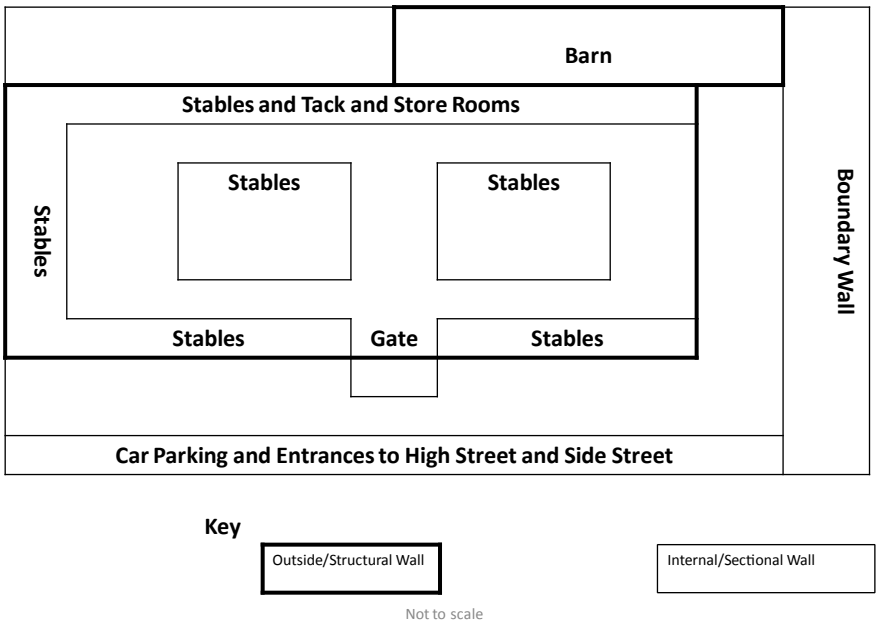


Figure 5.82. [redacted] Yard Plan

5.15.3. Content

[redacted]

[redacted]

5.15.4. Construction

The stable building is constructed of block with a sheet roof with an integral ventilation system within the roof space, and concrete floor.

The yard is designed so that the stables either back onto the external walls, are within a central block or face an external wall, which does not provide these occupants with a view.

The stables are sectional with a timber lower section with metal grill above to the front and solid timber partitions between stables (Figure 5.84.).

The doors are of sliding design so as not to restrict walkway access. The doors are of similar construction to the front of the stables, timber with a metal bar section above with a V in the metal section allowing the horse to put its head over the door. The slide release being one of the vertical metal bars within the door; allowing easy personnel use, but minimal chance of a horse opening it.

Windows are positioned at regular intervals along the externals walls. The glazed windows hinge at the top, and are secured at the base by a chain to prevent the window being opened too wide. Internally the glazed windows are protected by vertical metal bars. There is an integral ventilation system within the roof to enhance ventilation across the building (Figure 5.85.).

Additional light is provided by skylights, and fluorescent strip lighting.

The floor of each stable is concrete in a block pattern, with drainage channels along the front of each row of stables to remove liquid waste into a central drainage system.

5.15.5. Fixtures and Fittings

Each stable has an automatic waterer, metal corner manger and tie rings within the stable, and outside the door a folding saddle rack. At regular intervals outside the stables are swinging arm rug racks, but these have been secured to the wall at a low height and therefore the rugs can not be hung full length as they are designed to do.

5.15.6. Critical Appraisal

The site clearly demonstrates maximum horse capacity within a restricted area, but does not utilise stalls, thus reflecting the preference of stables over stalls. The specific needs of the horse have also been considered with regard to ventilation, including the utilisation of an integral ventilation system within the building, utilisation of automatic waterers in each stable and the provision of a drying stable with heat lamps and extensive allied storage areas. The external windows open outwards rather than in the traditional inwards fashion.

The use of specific non slip flooring in the farrier area indicates an understanding of the importance of a quality surface, though unfortunately has proven to be not as non slip as expected.

Space restrictions have been recognised, being demonstrated by the use of sliding doors, though unfortunately the space restriction has resulted in stables facing external walls. The appreciation that this is not ideal is noted, since these stables are only used when all the other stables are occupied.

The site demonstrates an appreciation of the importance of storage space, with specific storage areas, though unfortunately the rug storage racks, designed to allow a rug to hang full length have been fitted too low and thus only folded rugs can be held.

Though the site provides no opportunity for the horses to have free exercise the small internal yard does allow the horses some time out of their stable.



Figure 5.83. Pictorial view of Stable Building



Figure 5.84. Pictorial view of Stables



Figure 5.85. Pictorial view of Ventilation

5.16. [redacted]

5.16.1 Introduction and Location

[redacted]



Figure 5.86. [redacted] Location Map

[redacted]

5.16.2 Context

[redacted]

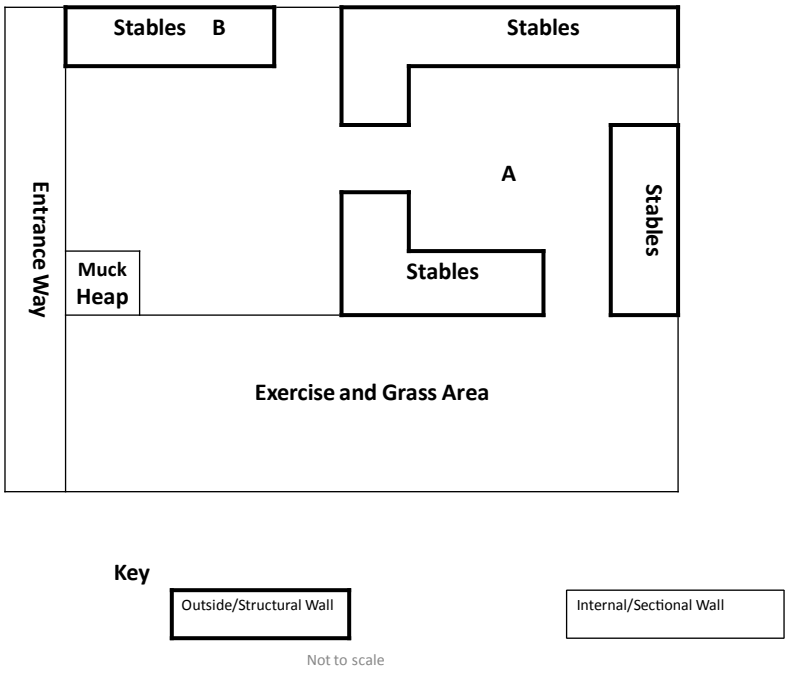


Figure 5.87. [redacted] Yard Plan

5.16.3. Content

[redacted]

5.16.4. Block A and Block B Construction

The stables are all of identical timber sectional design, with manufactured roofing resembling slate, an overhang to the front and concrete floors throughout.

Each stable has a traditional timber half door with the top door secured open to allow light and ventilation. The lower door has a metal sheet to prevent damage and a metal anti-weave grill on the top to allow the horse to look over the door but to deter weaving. The lower door is secured by a sliding bolt to the top, and a kick over bolt towards the base.

There are no windows within the stables. Additional light is provided by a domestic energy efficient bulb without any cover in each stable. The only ventilation provided being the open top half of the stable door.

Internally each stable is lined with timber to eaves height leaving the roofing timbers and space above the overhang open and able to collect dust.

Drainage from the stables occurs through the stable door and onto the external yard surface.

PVC rain water goods take rain water from the roof straight onto the yard surface where it drains across the yard to the central lawn area, though there is a separate yard drain in a corner where hay is soaked and a manhole cover within the lawn area indicating a drainage system.

5.16.5. Block A and Block B Fixtures and Fittings

Each stable has two plastic buckets clipped onto the wall, one to the front of the stable and one to the rear providing both feed and water. There are also two rings in the back wall of each stable, one in the corner and one in the centre.

Outside each stable is an individual head collar hook and a metal dustbin for rug storage (Figure 5.91.). Each stable door also has a card detailing information on the occupant including the horses racing colours. Each row of stables has a boxed in water tap and fastened nearby a water bucket scrubbing brush.

5.16.5. Critical Appraisal

[redacted]

The yard is aesthetically pleasing and is managed to a high standard of cleanliness and hygiene. The muck heap is conveniently located alongside the main gate for ease of yard labour and removal, but obscured from visitor view and also far enough away and regularly emptied, therefore not providing any offensive odour or negative health implications for the horses.

Stable ventilation is limited regarding the lack of windows or roof ventilation and the space above the overhang is open and collecting stable dust, all contributing negatively to the respiratory tract of the occupant, regardless of the management practices (such as soaking hay) undertaken to reduce respiratory disease.

Rain water goods flow straight onto the yard surface from down pipes with the resultant water flowing across the yard to the grass area and causing an ice slip hazard in the winter.

The use of bare energy efficient bulbs within the stables is undesirable, as although environmentally energy efficient; bare bulbs are a safety hazard without a security cover since the stable occupant may attempt to touch them and be injured and/or electrocuted.



Figure 5.88. Pictorial view of Entrance



Figure 5.89. Pictorial view of Main Yard



Figure 5.90. Pictorial view of Muck Heap



Figure 5.91. Pictorial view of Rug Bins

5.17. [redacted]

5.17.1. Introduction and Locations

[redacted]



Figure 5.92. [redacted] Location Map

[redacted]

5.17.2. Context

[redacted]

[redacted]

[redacted]

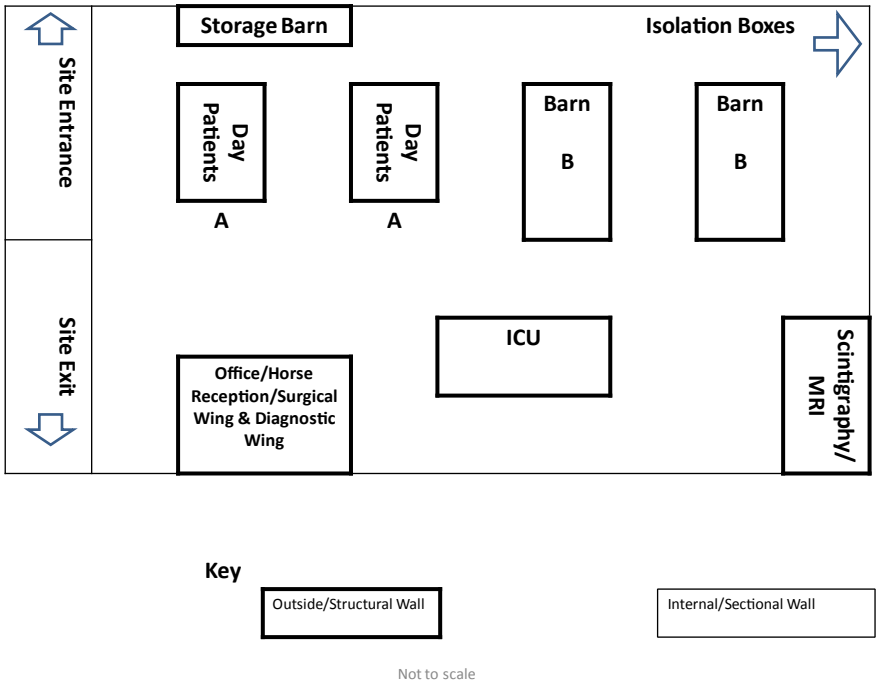


Figure 5.93. [redacted] Yard Plan

5.17.3. Content

[redacted]

[redacted]

[redacted]

[redacted]

Water is provided by a boxed in tap, with an integral short hose to allow ease of filling buckets. The taps are situated close to the yard drains.

Drainage from each stable occurs through the stable doorway and into a shallow drainage channel which runs in front of the row of stables.

Each row has a specific storage room.

5.17.5. Blocks A Fixtures and Fittings

Each stable has a cast concrete corner manger with a plug to enable cleaning, and a plastic water bucket which is attached on the wall by metal clip fastenings.

5.17.6. Blocks B Construction

The two American barns for longer term patients are of identical design, each containing eight horses on each side of two facing rows. The barns are constructed from brick, identical to the day stables, with sheet roofing containing skylights, and concrete floors.

There are large sliding double doors at each end of the barn with a shaped window above to allow for additional light. There are no windows within the American barns. Ventilation is provided by the sliding doors and roof ridge vents, additional light by fluorescent strip lighting.

Internally, the stables are divided by divisional block walls with sectional fronts and doors; the lower section being timber and an upper section a metal grill with a sliding door to avoid restricting the central corridor (Figure 5.95.).

Each stable drains through the doorway into a shallow drainage channel which runs along the front of each row of stables which flows into the site drainage system.

5.17.7. Blocks B Fixtures and Fittings

Fixtures and fittings are minimal, consisting of tie rings, water being supplied by plastic bucket.

5.17.8. Block C Isolation Stables

Isolation stables are provided at a distance from the main yards, and are of identical design to the day stables (Blocks A) (Figure 5.96.).

5.17.9. Block D [redacted]

[redacted]

5.17.10. Critical Appraisal

[redacted] demonstrates a successful move from an outgrown facility to a purpose designed and built facility.

The site demonstrates the clear separation of different aspects of the business; thus reducing disease risk and disturbance as much as possible. This relates to both office personnel, diagnostic facilities, short and long term patients, orthopaedic and abdominal or soft tissue surgery, intensive care and MRI/scintigraphy suites and also disposal facilities for waste and post mortem material.

The stables demonstrate the importance of ventilation utilising windows and roof ventilation, and also the importance of disease control by ensuring that each stable has its own individual air space which is not shared by a neighbour.

The addition of a mesh grill on the upper section of the lower half door demonstrates a clear understanding for ensuring natural light and ventilation by maintaining an open top door policy, but preventing an occupant (even a small foal) being able to become trapped, as may occur with a more traditional grill rather than the mesh which is utilised.

This is the only site studied which utilised bore water as well as the mains water supply which appears to be an unusual choice considering the nature of the business, the health status of the horses accommodated and that patients may find the bore water unpalatable.



Figure 5.94. Pictorial view of Day Boxes

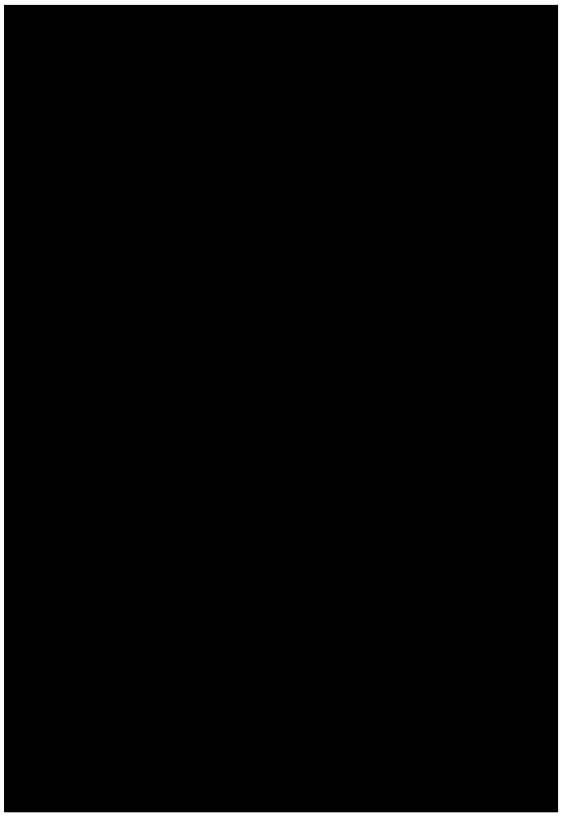


Figure 5.95. Pictorial view of American Barn



Figure 5.96. Pictorial view of Isolation Yard in Distance

5.18. [redacted]

5.18.1. Introduction and Location

[redacted]



Figure 5.97. [redacted] Location Map

[redacted]

5.18.2. Context

[redacted]

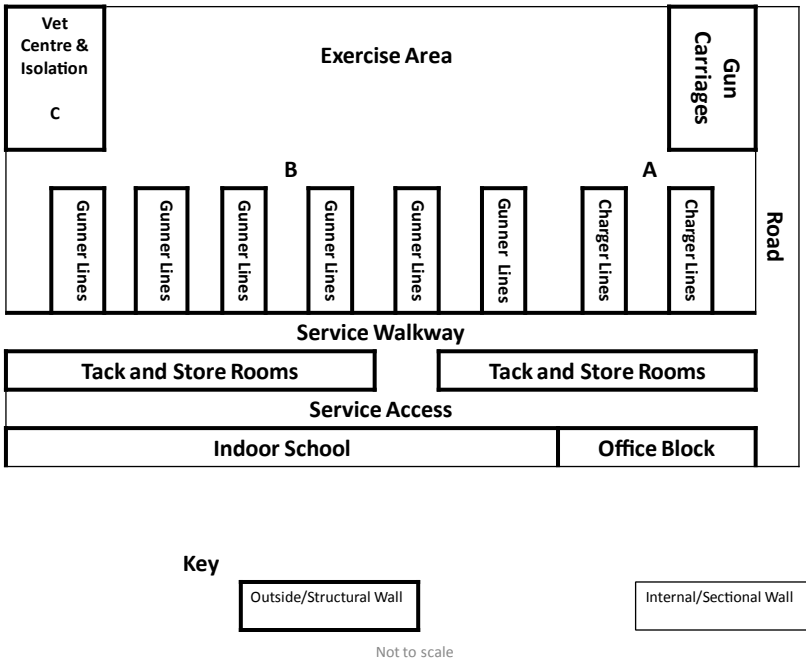


Figure 5.98. [redacted] Yard Plan

5.18.3. Content

[redacted]

[redacted]

5.18.4. Blocks A Construction

The stable blocks are all constructed identically; brick walls, zinc sheeting on the roof supported on a timber structure with an electronic roof ventilation system, and concrete floors. The building materials were all chosen to match the Rotunda, a circular brick building with a zinc “circus top” type roof which was built to store the spoils of the Napoleonic war.

The chargers are stabled in two blocks providing stabling for sixteen chargers with each block having four stables along each side of a central corridor (Figures 5.100. and 5.101.).

The stables are constructed of specially commissioned internal sectional stabling, the timber sections utilising bamboo for additional strength. Each stable has side and front sections constructed of a timber lower section and an upper metal grill section.

The stable door is central within the front wall, constructed of identical timber to the lower section of the stable walls. The door is secured by an upper latch set into the door and a lower kick bolt.

To the rear of each stable is an unglazed window protected by a metal grill with a timber door which can be secured open to aid ventilation. An integral roof ventilation system provides additional ventilation and fluorescent strip lights provide additional lighting. Large double half doors provide access and further light and ventilation at the far end of the building, away from the service corridor.

The corridor is block paved providing shallow drainage channels, which drain towards the rear of the building.

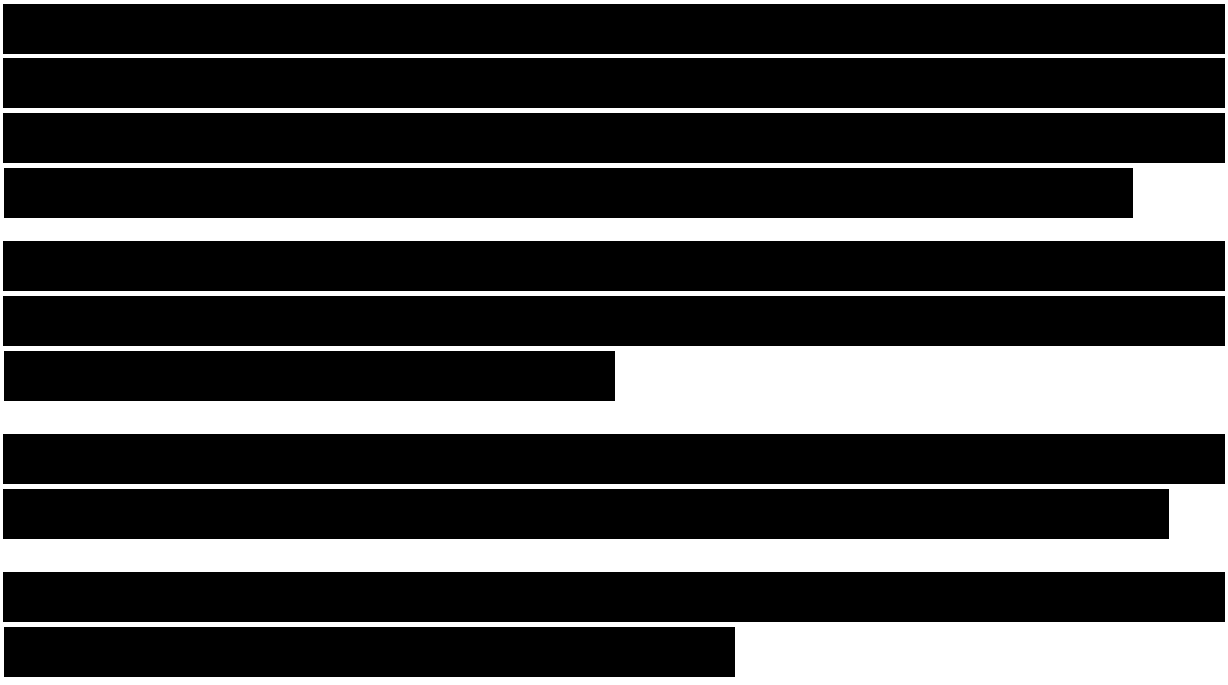


There are brick built muck bunkers within each courtyard.

5.18.5. Blocks A Fixtures and Fittings

Each stable has an automatic waterer, metal manger and tie ring. Outside each stable is a wipe board where horse care instructions are written and a high wooden saddle rack with metal head collar and bridle hook below.

5.18.5. Blocks B Construction



The floors within the sub sections are as the charger lines.

Each sub section has a large tack and harness room and allied storage areas across the service corridor from the stabling, and a courtyard with water troughs where the horses can be watered and hay soaked.

There are brick built muck bunkers within each courtyard.

5.18.6. Blocks B Fixtures and Fittings

Each stable and stall has an automatic water bowl, a feed manger and the stalls have a tie block to secure the horse thus reducing the risk of it catching a leg in a dangling rope.

5.18.7 Block C Construction

[redacted]

that the stables will be utilised for specialist treatment of the sick horse rather than disease isolated.

5.18.8 Block C Fixtures and Fittings

Fixtures and fittings are identical to those in Block A.

5.18.9. Critical Appraisal

[redacted]

Ventilation facilities and natural light are extensive with unglazed barred windows in every stable and stall, and the doors for these remaining open except in inclement weather and a bespoke roof ventilation system exists throughout the buildings.

Labour is saved with the use of automatic waterers, and personnel footfall has been kept to a minimum with each area of the site having separate storage facilities close by.

Vehicular traffic is restricted with cars being directed towards and behind the main administration building and delivery vehicles being restricted to the service area between the barns and the allied storage areas, thus horses and traffic can only meet when horses are crossing the service area to enter the indoor school.

Attention to detail regarding surfaces can be noted in the farriery workshop, with the use of specialist non slip concrete and a non slip wood block area where the horses are tied for shoeing. Unfortunately, the non slip concrete has proven to be anything but non slip and has had to be addressed to reduce accidents. This is the same for the wood block flooring which was varnished and polished, as a domestic floor and thus proved to be unsuitable for use with hot horse shoes. This has been rectified by the roughening and removal of the top polished surface to provide a non slip floor suitable for the intended purpose.

Extensive facilities for exercise, both indoor and outdoor facilities and the proximity to the common allow the horses to be exercised in all weathers adequately to meet their ceremonial duties. The indoor school was an existing building and is alleged to be one of the largest indoor arenas in the country being 120 x 80 meters whereas a standard international dressage arena is only 60 x 20 meters, therefore four could be accommodated within this arena. A similar sized outdoor arena a short distance up the roadway provides an additional large exercise area, whereas a smaller onsite outdoor arena provides a more restricted exercise area adjacent to the horse walker and exercise track.



Figure 5.99 Pictorial view of Main Building



Figure 5.100. Pictorial view of Charger Lines (Rear)



Figure 5.101. Pictorial view of Lucy's Stable (charger)



Figure 5.102. Pictorial view of Farriers Workshop



Figure 5.103. Pictorial view of Farrier Workshop



Figure 5.104. Pictorial view of Rotunda

Chapter Six

6. Case Study Data Analysis

Introduction

Following the completion of the literature review and also combined with the individual case study research, further analysis was undertaken regarding the field study sites. The key point being that the stabling provision must primarily provide a Fit for Purpose environment.

The data was analysed in a variety of ways to determine if the field study sites provided fit for purpose accommodation, and since it has been shown to be a realistic and relative sample of stabling sites within the UK, whether stabling facilities within the UK are fit for purpose.

6.1. Intra Case Study Data Analysis

Initially, each of the eighteen field study sites were evaluated (as a minimum fit for purpose standard) against the Code (DEFRA, 2006) (Appendix 3) for each of the headings as shown below in Table 6.4. and also evaluating social interaction and free exercise opportunities as emerged from the literature review.

Following the initial analysis, further detailed analysis was undertaken concerning a number of parameters, and measured against the data collated. The data was disaggregated by: Age of Stables (Pre 1900, Post 1900 pre 1980 and Post 1980); Number of Horses (Fewer than 30, 30 – 80, and Above 80); and Type of Horse (Commercial and Non-commercial).

The disaggregation of categories was justified taking into account the following:

6.1.1. Age of Stables

The Pre 1900 group accounts for the largely historic country house stables and commercial farm horses utilised prior to the end of the 19th Century; Post 1900 pre 1980 accounts for economic changes in the use of the horse pre and post World War I and II to the economic boom of the 1980s; and post 1980 takes into account more recent developments. As shown in Table 6.1.

Table 6.1. Age of Stables

Category	**Nr**	**% of Total Sample**
Pre 1990	6	(33%)
1900 – 1980	8	(50%)
Post 1980	4	(17%)

6.1.2. Number of Horses

Disaggregation by the total number of horses stabled at each case study site occurred to take into account small, medium and large stable sizes, thus allowing for data analysis across a range of stable sizes, to determine if differences occurred relating to the number of horses housed at each site. The categories were selected to reflect smaller sites (Fewer than 30 horses), including private yards; and exceptionally large establishments (Above 80 horses), with a mid range category being for 30 – 80 horses. as shown in Table 6.2.

Table 6.2. Number of Horses

Category	Nr	% of Total Sample
Fewer than 30 horses	7	(39%)
30 – 80 horses	7	39%)
Above 80 horses	4	(22%)

6.1.3. Type of Horse

Disaggregation by the type of horse allows for commercial sites to be compared against non-commercial sites; including leisure horses and those utilised for sporting and educational purposes. This disaggregation allowed for comparisons to be made between commercial horses and those of a non-commercial (economic) nature. The non-commercial sites include livery yards for private leisure horses, veterinary and educational stables.

Commercial sites include military and police stables, studs and race horse training stables. As shown in Table 6.3.

Table 6.3. Type of Horse

Category	Nr	% of Total Sample
Non-commercial	7	(39%)
Commercial	11	(61%)

6.1.4. Dimensions of stables

Additional analysis was also undertaken regarding the literature recommendations relating to the size of stables by Raabymagle and Ladewig (2006) and Pedersen *et. al. (*2004). Raabymagle and Ladewig (2006) recommending that the shortest stable wall should be at least 1.5 times the height of the horse at the withers, and that the footprint of the stable should be at least twice the height at the withers squared; Pedersen *et. al. (*2004) recommending that each stable wall should be twice the length of the horse. These have been chosen rather than earlier sources as these represent the most current published expression of Fitness for Purpose relating to the size of stables. This analysis was undertaken in addition to the basic analysis of stable size compliance shown in the DEFRA (2006) code.

6.1.5. Fitness for Purpose Criteria

The Fitness for Purpose criteria has been adapted from the DEFRA (2006) Code as justified in Table 6.4. Additional explanation/justification has been collated from the sources from within the literature review. The Fitness for Purpose criteria are shown below in detail in Table 6.4.

Table 6.4. Fitness for Purpose Criteria

Construction	The building should be constructed soundly, with no exposed surfaces or projections likely to cause injury. All surfaces should be capable of being cleaned and disinfected. If surfaces are treated, non-toxic paints or wood preservatives should be used.		
Fixtures and fittings	Such as tie rings, hay racks and water bowls should be free of sharp edges and positioned so as to avoid injury, particularly to the eyes. If used, hay nets should be fixed at the horse's head height, allowing the horse to eat comfortably yet avoiding the risk of the horse getting its feet or head collar caught in the net when empty.		
Floors	Should be reasonably even, non-slip and designed to give good drainage, taking stable waste away from the horse.		
Doors	Should be a minimum of 1.25m (4 ft) wide. The height of the door should allow the horse or pony to look out with the head comfortably over the door. The bottom door should be capable of being securely fastened with top and bottom bolts. Stables may also have a top door which should be capable of being secured in the open position. Shutting the top door reduces ventilation and natural light.		
Roofs	Should be high enough to provide adequate ventilation including good air circulation. There should be a minimum clear space to the eaves of 60-90 cm (2-3 ft) above the ears of the horse in its normal standing position.		
Light	Sufficient light is essential within all stabling both for the horse to see adequately, and also to enable inspection and safe handling of horses at all times. This can include portable lighting. Light bulbs should be enclosed in safety fittings with cabling secured well out of reach.		
Windows and ventilation slats	Should provide adequate air circulation without creating draughts. Perspex or safety glass (with grilles fitted between the horse and the glass) is advisable. One window or top door should normally be open at all times.		
Stable size	Horses	3.65m x 3.65m	12ft x 12ft
	Large horses	3.65m x 4.25m	12ft x 14ft
	Ponies	3.05m x 3.05m	10ft x 10ft
	Large ponies	3.05m x 3.65m	10ft x 12ft
	Foaling box (horse)	4.25m x 4.25m	14ft x 14ft
Social Interaction (SI)	The ability for the horse to see and communicate with its neighbour.		
Free Exercise (FE)	The horse having the facility and opportunity to exercise without human constraint, for example in an all weather arena or paddock.		

DEFRA (2006); Borsheim, *et. al.*, (2008); Harewood and McGowan (2005); Kiley-Worthington (1997); McBane, (1992); McGreevy *et. al*. (1995); Nagy *et. al.* (2008); Rose – Meierhöfer *et. al.* (2010); Specialequinesearch (2007); Werhahn *et. al.* (2011) and Winther Christensen *et. al.* (2002)

It is impossible to categorically prioritise the positive attributes of the individual criteria (Table 6.4) as each plays an important role in ensuring that the horse is maintained in a safe and suitable environment. Equally some of the attributes entirely compensate for the omission of another attribute. For example 'Yorkshire' boarding compensates for the lack of a window for both light and ventilation criteria. Other attributes may ameliorate the negative aspects of an attribute, for example the lack of a lower stable half door bolt is ameliorated by the door opening inwards, and thus being difficult for the stable occupant to open the door even if the top bolt is opened.

Any positive attribute which is lacking will have an unquantifiable detrimental effect on the horses wellbeing, and deem the stabling situation as not meeting the DEFRA (2006) and Social Interaction and Free Exercise criteria, and therefore not being Fit for Purpose (DEFRA, 2006; Borsheim, *et. al.*, 2008; Harewood and McGowan, 2005; Kiley-Worthington, 1997; McBane, 1992; McGreevy *et. al*., 1995; Nagy *et. al.,* 2008; Rose – Meierhöfer *et. al.,* 2010; Specialequinesearch, 2007; Werhahn *et. al.,* 2011 and Winther Christensen *et. al.,* 2002). This evaluation of Fitness for Purpose is presented later.

Table 6.4. details DEFRA Criteria (2006) which divides stable size into horse; large horse; ponies; large ponies and foaling boxes. However the particular specifications for: horses; large horses; ponies; and large ponies; were not specified within the source.

For the purpose of this study stable sizes will be evaluated regarding horses and large horses, with the assumption that the majority of stable yards house a variety of horses and ponies, therefore provision suitable for a large horse will be suitable for a horse, and provision for a horse will be suitable for a pony (thus descending in size criteria).

As DEFRA (2006) does not specify how horses and large horses are differentiated, the division has been equated at 16.2hh, therefore horses being between 14.2hh and 16.2hh, and large horses exceeding 16.2hh (ponies being 14.2hh or less) (Pony Club, 1988).

Foaling boxes will not be evaluated as a separate entity, as they are a rare occurrence within the majority of stable yards, except those specially designed for breeding stock, and even then, no criteria concerning the size of the box relevant to the occupant has been found in any literature source.

Fitness for Purpose also includes the evaluation of the case study data against criteria defined for the minimum length of the shortest stable wall; 1.5 times withers height (Raabymagle and Ladewig, 2006), and 2 times the length of the horse (Pedersen *et. al.*, 2004), even though DEFRA (2006) does not refer to this particular item. This omission from the DEFRA (2006) Code has been evaluated in the literature review.

Fitness for Purpose also includes the evaluation of the minimum floor foot print; 2 times withers height, squared (Raabymagle and Ladewig, 2006). The same qualifications against the DEFRA (2006) Code has been made earlier in the literature review.

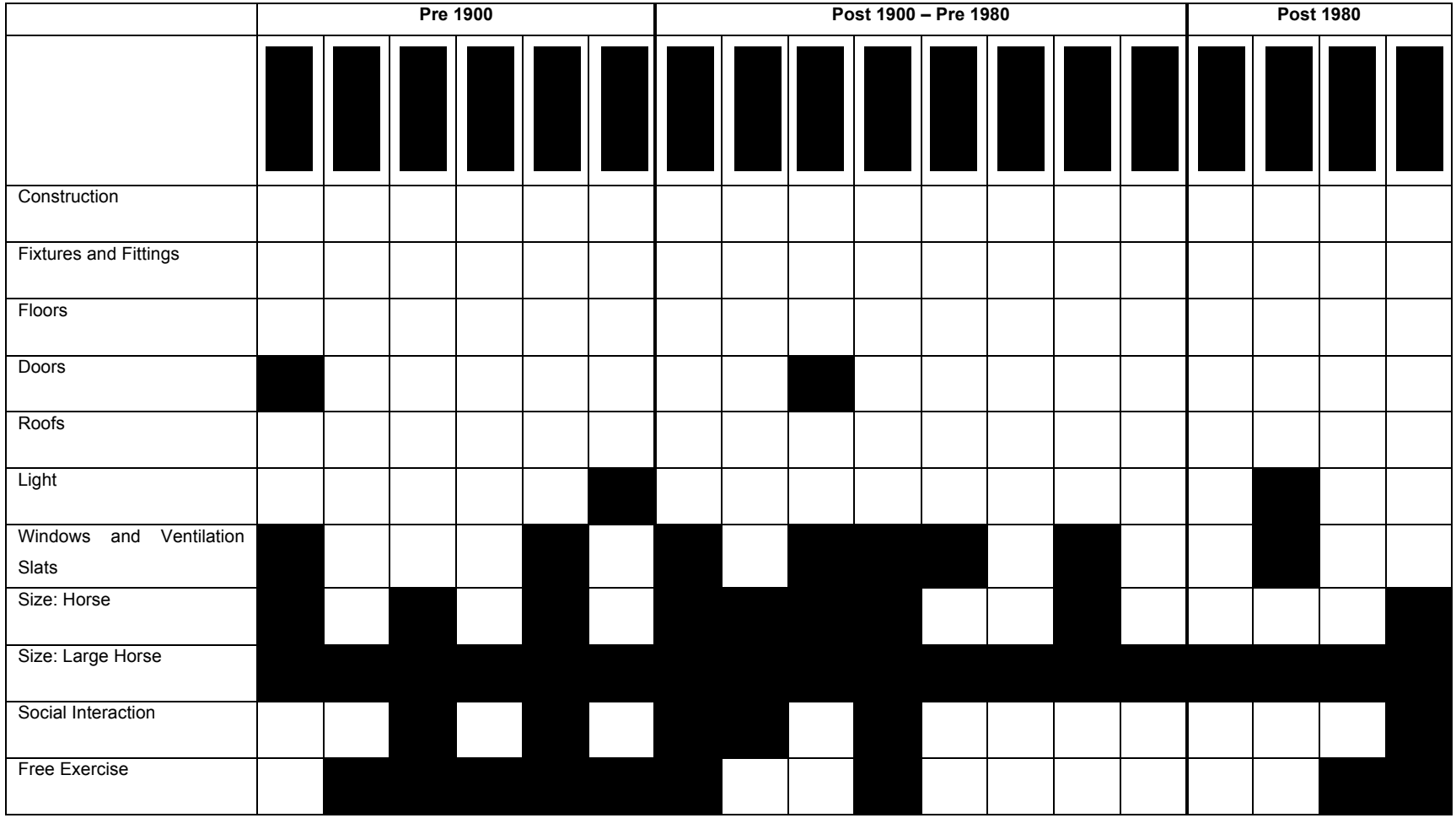
Social Interaction and Free Exercise have been included for analysis reflecting the literature reviewed by authors including Borsheim, *et. al.*, (2008); Harewood and McGowan (2005); Kiley-Worthington (1997); McBane, (1992); McGreevy *et. al*. (1995); Nagy *et. al.* (2008); Rose – Meierhöfer *et. al.* (2010); Specialequinesearch (2007); Werhahn *et. al.* (2011) and Winther Christensen *et. al.* (2002).

6.1.6. Analysis Overall

Tables 6.5. 6.6. and 6.7. illustrate the case study sites against DEFRA (2006) criteria, and Social Interaction and Free Exercise expectations from the literature review disaggregated by Age of Stables, Number of Horses and Type of Horse (Borsheim, *et. al.*, 2008; Harewood and McGowan 2005; Kiley-Worthington 1997; McBane, 1992; McGreevy *et. al*. 1995; Nagy *et. al.* 2008; Rose – Meierhöfer *et. al.* 2010; Specialequinesearch 2007; Werhahn *et. al.,* 2011 and Winther Christensen *et. al.*, 2002).

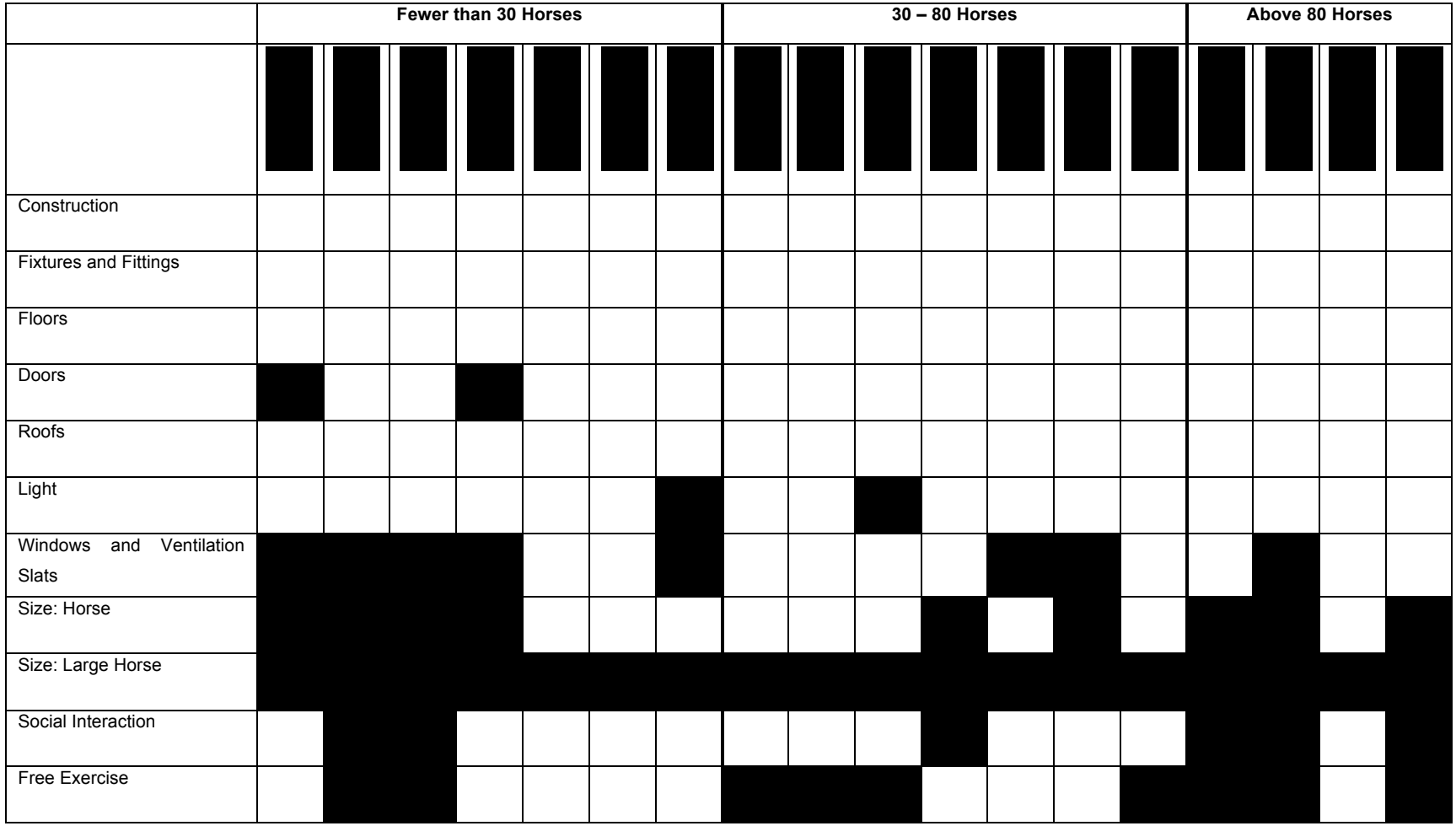
Analysis of Tables 6.5. 6.6. and 6.7. follow Table 6.7.

Table 6.5. Case Study Assessment DEFRA (2006) and Social Interaction and Free Exercise Criteria Disaggregated by Age of Stables



Fails to meet DEFRA (2006) criteria and Social Interaction and Free Exercise provision. Meets DEFRA (2006) criteria and Social Interaction and Free Exercise provision. Criteria applied to all stables on site. Therefore if a single stable fails to meet the criteria, all stables for that site are marked as failing to meet the criteria. **XX** Indicates that stalls are present on site, therefore the minimal stable requirements are not met throughout the facility.

Table 6.6. Case Study Assessment DEFRA (2006) and Social Interaction and Free Exercise Criteria Disaggregated by Number of Horses



Fails to meet DEFRA (2006) criteria and Social Interaction and Free Exercise provision. Meets DEFRA (2006) criteria and Social Interaction and Free Exercise provision. Criteria applied to all stables on site. Therefore if a single stable fails to meet the criteria, all stables for that site are marked as failing to meet the criteria. **XX** Indicates that stalls are present on site, therefore the minimal stable requirements are not met throughout the facility.

Table 6.7. Case Study Assessment DEFRA (2006) and Social Interaction and Free Exercise Criteria Disaggregated by Type of Horse

	Non-commercial							Commercial										
Construction																		
Fixtures and Fittings																		
Floors																		
Doors																		
Roofs																		
Light																		
Windows and Ventilation Slats																		
Size: Horse																		
Size: Large Horse																		
Social Interaction																		
Free Exercise																		

Fails to meet DEFRA (2006) criteria and Social Interaction and Free Exercise provision. Meets DEFRA (2006) criteria and Social Interaction and Free Exercise provision. Criteria applied to all stables on site. Therefore if a single stable fails to meet the criteria, all stables for that site are marked as failing to meet the criteria. **XX** Indicates that stalls are present on site, therefore the minimal stable requirements are not met throughout the facility.

Table 6.5 illustrates individual case study assessments of the DEFRA (2006) criteria, social interaction and free exercise combined for sites pre 1900; post 1900 – pre 1980 and post 1980.

6.1.6.1. Age of Stables

Pre 1900

Construction

Construction at all the sites within the Pre 1900 category meet DEFRA (2006) requirements.

Fixtures and Fittings

The fixtures and fittings at all sites meet DEFRA (2006) requirements.

Floors

The floors at all sites meet DEFRA (2006) requirements.

Doors

Within the Pre 1900 category there is one site where not all doors meet the DEFRA (2006) requirement; [redacted], where a number of the stables have doors which open inwards, rather than outwards. This has to be considered regarding Fitness for Purpose as a horse could become trapped in the stable, and entry obstructed due to the door not opening outwards.

Roofs

The roofs at all sites meet DEFRA (2006) requirements.

Light

Lighting does not meet DEFRA (2006) requirements at one site within the Pre 1900 category; [redacted], where bare domestic light bulbs were utilised. This brings into question Fitness for Purpose due to the safety issues of the use of a bare domestic light bulb.

Windows and Ventilation Slats

Windows and ventilation indicate two instances within the Pre 1900 category where DEFRA (2006) requirements are not met. At [redacted] not all stables have windows, but this was not considered to be negative regarding Fitness for Purpose due to an extensive use of alternative methods of providing light and ventilation, including the use of Yorkshire Boarding, and stable dividing walls not reaching above eaves height, providing additional ventilation and light to what is provided via the open upper section of the stable door.

Size: Horse

Within the Pre 1900 category, 50% of sites did not meet the DEFRA (2006) category due to stables at these sites not all being complaint with the size specifications for horses. Two sites also utilised stalls, which do not meet the DEFRA (2006) criteria. This brings into question the Fitness for Purpose of 50% of study sites due to the size of the stables utilised.

Size: Large Horse

None of the sites within the study fully meet the requirements regarding the size of stables for a large horse, thus indicating that there are limited adequate facilities for large horses, and that the stables in use have to be considered regarding Fitness for Purpose concerning this factor.

Social Interaction

Social Interaction at two sites within the Pre 1900 category do not meet the requirements of DEFRA (2006); *et. al*. Both these sites utilise stalls, and thus demonstrate that where stalls are utilised, social interaction is negative, thus bringing into question the Fitness for Purpose of the use of stalls.

Free Exercise

Free exercise does not meet DEFRA (2006) *et. al*. requirements at 5 sites (83%). The only site which is complaint being [redacted] the only agricultural site within the category. The lack of free exercise at sites within this category is a Fitness for Purpose concern.

Post 1900 – Pre 1980

Construction

Construction at all the sites within the Pre 1900 category meet DEFRA (2006) requirements.

Fixtures and Fittings

The fixtures and fittings at all sites meet DEFRA (2006) requirements.

Floors

The floors at all sites meet DEFRA (2006) requirements.

Doors

Within the Post 1900 – Pre 1980 category there is one site where not all doors meet the DEFRA (2006) requirement; [redacted] where metal gates are utilised rather than traditional stable doors. This has to be considered regarding Fitness for Purpose as security of the gate provision has to be considered.

Roofs

The roofs at all sites meet DEFRA (2006) requirements.

Light

Lighting at all sites meet DEFRA (2006) requirements.

Windows and Ventilation Slats

The Post 1900 – Pre 1980 category contains the highest number of none DEFRA (2006) compliant sites within the study, with Nr 5 (63%) being non-compliant. None compliance was specific to the lack of windows utilised within these sites, and even though ventilation grills and also integral ventilation systems were utilised Fitness for Purpose was questioned.

Size: Horse

Nr 5 (63%) of sites do not meet DEFRA (2006) requirements concerning the size of stables for a horse, with Nr 4 sites (50%) utilising stalls, and the other non-compliant site

utilising stables which do not meet the specified criteria. This brings into question the Fitness for Purpose of these sites.

Size: Large Horse

None of the sites within the study fully meet the requirements regarding the size of stables for a large horse, thus indicating that there are limited adequate facilities for large horses, and that the stables in use have to be considered regarding Fitness for Purpose concerning this factor.

Social Interaction

The Post 1900 – Pre 1980 category provides the highest number of sites which do not fully conform to the DEFRA (2006) *et. al*. requirements (38%), these sites (Nr 3) being sites where stalls are utilised, bringing into question the Fitness for Purpose of these sites.

Free Exercise

Free exercise provision in the Post 1900 – Pre 1980 category illustrates the highest percentage (75%) of sites compliant with DEFRA (2006) ; *et. al*. criteria. This demonstrates an improving trend from the Pre 1900 category. The two non-compliant categories being both inner city, commercial sites with no free exercise facilities, which brings into question Fitness for Purpose.

Post 1980

Construction

Construction at all the sites within the Pre 1900 category meet DEFRA (2006) requirements.

Fixtures and Fittings

The fixtures and fittings at all sites meet DEFRA (2006) requirements.

Floors

The floors at all sites meet DEFRA (2006) requirements.

Doors

The doors at all sites meet DEFRA (2006) requirements.

Roofs

The roofs at all sites meet DEFRA (2006) requirements.

Light

Lighting does not meet DEFRA (2006) requirements at one site within the Post 1980 category; [redacted], where bare domestic light bulbs were utilised. This brings into question Fitness for Purpose due to the safety issues of the use of a bare domestic light bulb.

Windows and Ventilation Slats

The Post 1900 category demonstrates the highest percentage (75%) DEFRA (2006) compliant sites regarding windows and ventilation, with only one site being non-compliant due to a lack of windows, ventilation being provided by the open top half of the stable door. This does bring into question the Fitness for Purpose of windows and ventilation at this site.

Size: Horse

75% (3 Nr) of sites are compliant regarding DEFRA (2006) criteria. 25% (1 Nr) are non-compliant due to the use of stalls. This brings into question Fitness for Purpose.

Size: Large Horse

None of the sites within the study fully meet the requirements regarding the size of stables for a large horse, thus indicating that there are limited adequate facilities for large horses, and that the stables in use have to be considered regarding Fitness for Purpose concerning this factor.

Social Interaction

The Post 1980 category provides the highest percentage (75%) of sites which conform to DEFRA (2006) ; *et. al*. requirements. The single non-compliant site utilises stalls, bringing into question the Fitness for Purpose regarding social interaction.

Free Exercise

The Post 1980 category illustrates that 50% (2 Nr) of sites are compliant, but that 50% (2 Nr) of sites are non-compliant with DEFRA (2006); *et. al*. The two non-compliant sites are the two most recently completed, which does bring into question Fitness for Purpose at these two sites.

Age of Stables Conclusion

It can be concluded that construction, fixtures and fittings, floors and roofs are all fully compliant with DEFRA (2006) criteria.

Two sites where doors do not meet the DEFRA (2006) criteria are in the Pre 1900 and Post 1900 – Pre 1980 categories, not in the Post 1980 category, demonstrating a positive trend regarding age of stables.

Lighting was deficient at two sites, where bare domestic light bulbs were utilised within the Pre 1900 and Post 1980 categories, therefore not demonstrating a trend regarding the age of stables.

Windows and ventilation indicates a higher degree of sites meeting DEFRA (2006) requirements in the sites within the Post 1980 category, with only one site failing to meet the requirements by not having any windows within any of the stables, the only ventilation being provided by the open top half of the stable door. The other non-compliant sites utilised a variety of ventilation methods, including mechanical systems at three of the sites.

Regarding the size of stables within the study sites, the Post 1900 – pre 1980 category exhibits the largest proportion of sites which fail DEFRA (2006) requirements for horses, and also the largest proportion of sites where stalls are utilised. The data demonstrates that the largest percentage of compliant sites are in the Post 1980 category.

None of the sites fully meet the requirements regarding the size of stables for a large horse, thus indicating that there are limited adequate facilities for large horses, and that the stables in use have to be considered as failing the Fitness for Purpose criteria concerning this factor.

Social interaction data indicates the more positive situation in case study sites in the Post 1980 category, with Post 1900 – Pre 1980 providing the highest number of sites which do not fully conform to the requirements, these three sites being also sites which do not conform to window and ventilation standards or the size required for a horse, thus bringing into question the overall Fitness for Purpose of these sites.

Free exercise provision data illustrates a significant difference between sites in the Pre 1900 category, and the later part of the Post 1900 – Pre 1980 category, and the Post 1980 category, illustrating that the majority of sites developed more recently have free exercise facilities, with the exception of the two most recently completed sites, though an explanation for this could be defined as [redacted] not requiring free exercise facilities as the occupants are either day patients, or more seriously ill and therefore free exercise would be inappropriate, and at [redacted], that the horses are in adequate work to minimise their need for free exercise on a daily basis, and that there is the extensive opportunity for free exercise when they attend their "summer holiday" vacation in the country, negating the requirement for daily free exercise provision.

Table 6.6. is similar to Table 6.5., except that the data has been disaggregated by the number of horses, rather than the age of the stables.

6.1.6.2. Number of Horses

Fewer than 30 Horses

Construction

Construction at all sites meet DEFRA (2006) requirements.

Fixtures and Fittings

The fixtures and fittings at all sites meet DEFRA (2006) requirements.

Floors

Floors at all sites meet DEFRA (2006) requirements.

Doors

72% (5 Nr) of sites met DEFRA (2006) requirements concerning stable doors. 28% (2 Nr) of sites which did not meet the criteria failed due to doors opening inwards rather than outward, or the use of gates rather than traditional stable doors.

Roofs

The roofs at all sites meet DEFRA (2006) requirements.

Light

Lighting failed the DEFRA (2006) requirements at one site within the Fewer than 30 Horses category due to the utilisation of bare domestic light bulbs. This brings into question Fitness for Purpose of the lighting provision.

Windows and Ventilation Slats

Windows and Ventilation Slats failure to comply with DEFRA (2006) criteria was highest within the Fewer than 30 Horses category, than the 30 – 80 Horses Category or the Above 80 Horses Category, with 72% (5 Nr) of sites being non-compliant. This brings into question Fitness for Purpose.

Size: Horse

DEFRA (2006) criteria at 43% (3 Nr) were compliant, with 57% (Nr 4) non-compliant. A single site that was not compliant did not utilise stalls, whereas three sites did, thus bringing into question Fitness for Purpose.

Size: Large Horse

None of the sites within the study fully meet the requirements regarding the size of stables for a large horse, thus indicating that there are limited adequate facilities for large horses, and that the stables in use have to be considered regarding Fitness for Purpose concerning this factor.

Social Interaction

100% (7 Nr) of sites were compliant regarding social interaction Fitness for Purpose.

Free Exercise

Free exercise facilities were compliant at 72% (5 Nr) sites. The two non-compliant sites ([redacted]) were inner city sites for commercial horses with no free exercise provision. A similar inner city commercial site ([redacted]) provides a small free exercise provision, which though limited in terms of space, does provide compliance with requirements.

30 – 80 Horses

Construction

Construction at all sites meet DEFRA (2006) requirements.

Fixtures and Fittings

The fixtures and fittings at all sites meet DEFRA (2006) requirements.

Floors

Floors at all sites meet DEFRA (2006) requirements.

Doors

Doors at all sites meet DEFRA (2006) requirements.

Roofs

The roofs at all sites meet DEFRA (2006) requirements.

Light

Lighting failed the DEFRA (2006) requirements at one site within the 30 – 80 Horses category due to the utilisation of bare domestic light bulbs. This brings into question Fitness for Purpose of the lighting provision.

Windows and Ventilation Slats

Windows and ventilation slats complied with DEFRA (2006) criteria at 72% (5 Nr) of sites. This brings into question Fitness for Purpose at 28% (2 Nr) sites.

Size: Horse

72% (5 Nr) of sites within the 30 – 80 horses category comply with DEFRA (2006) criteria. At the 28% (2 Nr) sites which were non-compliant, [redacted] utilised stalls, and [redacted] provided a range of stable sizes, thus not all stables at this site were compliant or non-compliant.

Size: Large Horse

None of the sites within the study fully meet the requirements regarding the size of stables for a large horse, thus indicating that there are limited adequate facilities for large horses, and that the stables in use have to be considered regarding Fitness for Purpose concerning this factor.

Social Interaction

A single site [redacted] was non-compliant concerning social interaction, due to the use of stalls. This brings into question fitness for Purpose at this site.

Free Exercise

Free exercise is compliant at 43% (3 Nr) sites, all which have paddock turn out facilities. Two of the non-compliant sites; [redacted] provide care for sick or injured horses, and the other two non-compliant sites [redacted] are commercial sites. This brings into question Fitness for Purpose at these non-compliant sites.

Above 80 Horses

Construction

Construction at all sites meet DEFRA (2006) requirements.

Fixtures and Fittings

The fixtures and fittings at all sites meet DEFRA (2006) requirements.

Floors

Floors at all sites meet DEFRA (2006) requirements.

Doors

Doors at all sites meet DEFRA (2006) requirements.

Roofs

The roofs at all sites meet DEFRA (2006) requirements.

Light

Light provision at all sites meet DEFRA (2006) requirements.

Windows and Ventilation Slats

Windows and ventilation slats are compliant at 75% (3 Nr) of sites in the Above 80 Horses category. The non-complaint site does not have windows, deeming it non-compliant, but large fans are utilised to increase air flow across the building, though even with the use of fans, the lack of windows brings into question Fitness for Purpose.

Size: Horse

25% (1 Nr) of sites is DEFRA (2006) compliant. 75% (3 Nr) of non-compliant sites utilise stalls, bringing into question Fitness for Purpose.

Size: Large Horse

None of the sites within the study fully meet the requirements regarding the size of stables for a large horse, thus indicating that there are limited adequate facilities for large horses, and that the stables in use have to be considered regarding Fitness for Purpose concerning this factor.

Social Interaction

25% (1 Nr) of sites is DEFRA (2006); *et. al*. compliant concerning social interaction. 75% (3 Nr) of non-compliant sites utilise stalls, bringing into question Fitness for Purpose at these sites.

Free Exercise

25% (1 Nr) of sites is DEFRA (2006); *et. al*. compliant concerning free exercise. 75% (3 Nr) of the sites within the Above 80 Horses category provide no free exercise provision, bringing into question Fitness for Purpose at these sites.

Number of Horses Conclusion

It can be concluded that construction, fixtures and fittings, floors and roofs are all fully compliant with DEFRA (2006) criteria.

Two sites where doors do not meet the DEFRA (2006) criteria are in the Fewer than 30 Horses category, demonstrating that stable doors are more likely to be compliant where greater numbers of horses are stabled.

The two sites with lighting deficiencies against DEFRA (2006) criteria fit into the fewer than 30 horses and 30 – 80 horses respectively, thus illustrating a move towards compliant lighting within the larger sites (above 80 horses).

Table 6.6. illustrates that windows and ventilation demonstrate a higher degree of non-compliance regarding DEFRA (2006) at the smaller sites studies (Fewer than 30 horses). All these sites are categorised as failing to meet the above stated criteria due to a lack of windows being present, though ventilation is provided via alternative sources than windows, such as Yorkshire boarding, thus not impinging on the actual ventilation provision within the buildings.

The size of stable (horse) illustrates that there is a greater degree of compliance regarding DEFRA (2006) criteria in the 30 – 80 horse category. This reflects the use of stalls also, with stalls being apparent at only one site in this category. This can be interpreted as sites with Fewer than 30 horses being fully utilised, thus maximum stabling incorporated into a specific footprint, thus resulting in stable size being restrictive. Sites with Above 80 horses reflects this trend also, with maximum stabling required on a specific footprint, and a high use of stalls, again reflecting the need to accommodate a large number of horses within a minimal building footprint.

As in Table 6.5., Table 6.6. reflects that no sites fully meet the DEFRA (2006) requirements regarding size of stable for large horses.

Table 6.6. illustrates that social interaction is adequate at all sites within the Fewer than 30 horses category, and at all but one site in the 30 – 80 horse category, but only one site in the Above 80 horses category reflects this trend.

Free exercise reflects a decreasing trend, with the majority of sites in the Fewer than 30 horse category complying, approximately half of sites in the 30 – 80 horse category complying and only a quarter of sites complying where above 80 horses are stabled.

Table 6.7 reflects identical data to Tables 6.5. and 6.6., though disaggregated by type of horse; non-commercial and commercial.

6.1.6.3. Type of Horse

Non Commercial

Construction at all the sites meet DEFRA (2006) requirements.

Fixtures and Fittings

The fixtures and fittings at all sites meet DEFRA (2006) requirements.

Floors

The floors at all sites meet DEFRA (2006) requirements.

Doors

Doors at 2 Nr (29%) of non-commercial sites do not meet DEFRA (2006) criteria. At [redacted] there are doors which open inwards rather than outwards, and at [redacted] gates are utilised instead of traditional stable doors. This brings into question Fitness for Purpose.

Roofs

The floors at all sites meet DEFRA (2006) requirements.

Light

Lights at all sites meet DEFRA (2006) requirements.

Windows and Ventilation Slats

43% (3 Nr) of non-commercial sites are compliant with DEFRA (2006) criteria concerning windows and ventilation slats. This brings into question Fitness for Purpose.

Size: Horse

Non-commercial sites exhibit 57% (4 Nr) DEFRA (2006) compliance. [redacted] of the non-compliant sites exhibit a variety of stable sizes, therefore not full compliance, and one site ([redacted]) utilises stalls, therefore being non-compliant with DEFRA (2006) requirements.

Size: Large Horse

None of the sites within the study fully meet the requirements regarding the size of stables for a large horse, thus indicating that there are limited adequate facilities for large horses, and that the stables in use have to be considered regarding Fitness for Purpose concerning this factor.

Social Interaction

Social Interaction at all non-commercial sites meet DEFRA (2006); *et. al*. requirements.

Free Exercise

Non-commercial free exercise sites are 72% compliant. The two sites which are non-compliant are both sites providing veterinary care, thus it can be questioned if free exercise is appropriate for the resident patients.

Commercial

Construction

All sites meet DEFRA (2006) requirements.

Fixtures and Fittings

All sites meet DEFRA (2006) requirements.

Floors

All sites meet DEFRA (2006) requirements.

Doors

All sites meet DEFRA (2006) requirements.

Roofs

All sites meet DEFRA (2006) requirements.

Light

Lighting is compliant at 82% (9 Nr) commercial sites. The two non-compliant sites utilise bare domestic light bulbs, thus bringing into question Fitness for Purpose.

Windows and Ventilation Slats

66% (7 Nr) of non-commercial sites are DEFRA (2006) compliant. Failure to comply is due to the lack of windows, though alternative ventilation methods, including mechanical mechanisms are utilised at the non-compliant sites.

Size: Horse

45% (5 Nr) of commercial sites are DEFRA (2006) compliant. 55% (6 Nr) are non-compliant due to the use of stalls at all these sites, which brings into question Fitness for Purpose.

Size: Large Horse

None of the sites within the study fully meet the requirements regarding the size of stables for a large horse, thus indicating that there are limited adequate facilities for large horses, and that the stables in use have to be considered regarding Fitness for Purpose concerning this factor.

Social Interaction

Social Interaction compliance occurs at 45% (5 Nr) of sites, therefore questioning Fitness for Purpose.

Free Exercise

Fitness for Purpose is questioned regarding free exercise with only 36% (4 Nr) sites being compliant.

Type of Horse Conclusion

As in Tables 6.5. and 6.6. construction, fixtures and fittings, floors and roofs are compliant with DEFRA (2006) at all sites.

Doors are compliant at all sites except two, which are both non-commercial sites. In contrast, two sites with inadequate lighting are both commercial. Windows and ventilation sites which do not meet DEFRA (2006) criteria are equally spaced within the non-commercial and commercial categories.

Stable size illustrates that non-commercial and commercial sites reflect both compliance and noncompliance with regard to the horse, with commercial sites illustrating all but one site where stalls are utilised. The data reflects the almost complete move from the use of the stall for the non-commercial horse, and the relatively extensive current use of the stall for the commercial horse. Stable size for the large horse reflects the data in Tables 6.5 and 6.6., that no site completely complies with the DEFRA (2006) requirements for a large horse.

Social interaction and free exercise illustrates that all sites which are not complaint with social interaction requirements are commercial, and the majority of non-compliant free exercise sites are commercial, though two are non-commercial.

This data reflects that the non-commercial horse is much more likely to be accommodated where social interaction and free exercise are as required, whereas the commercial horse is much more likely to be accommodated where social interaction and free exercise are not compliant.

The following sections give an overview of compliance with the DEFRA code. A detailed disaggregated analysis is presented in section 6.2. later.

6.1.7. General Construction

The materials which the case study stables were constructed from varied from traditional materials such as stone and timber, to manufactured concrete block and brick. The roofing materials generally corresponded to the walling materials, thus stone and brick stables correlated generally with slate or tile being utilised for the roof, and timber stables generally having sheet or felt roofs.

[redacted] utilised sheet or felt as a roofing material throughout, corresponding with the modern nature of the stabling, both the purpose built timber stabling with felt roofs and also the agricultural buildings with sheet roofs. In contrast [redacted] utilised brick and tile throughout, the newer stabling being constructed in such a fashion as to match the original stable block as closely as possible with regard to the materials utilised.

[redacted] was the only example within the study to exhibit the use of a thatched roof, which in a similar fashion to [redacted] was utilised to match another original building, in this case the main residence rather than a previous stable block. Minahan (1999) describes Balaton Lodge in Newmarket as utilising thatch as a roofing material, but this yard no longer houses horses as it has been converted into a residential property. It appears from the work of Blundevil (1565) that even at that time the use of thatch was declining with a preference for tiles instead. This may have been due to the increased popularity of the tile, and also slate, but also the realisation of the fire risk of utilising thatch. Regardless of the reason, today very few examples of thatched stabling exists, thus [redacted] being a relatively recent development, (1980's) demonstrating a mixture of block walling and a thatched roof may be a totally unique example of this construction.

[redacted] is the only case study site which exhibits the use of rendered and painted blocks throughout, utilised for both practicality and economy, but also to produce an aesthetically pleasing collection of buildings across a landscaped area of gardens and paddocks. Tiles are utilised as a roofing material across the whole site, with the exception of an American Barn, which has a sheet roof. It is understood that the American Barn is not generally utilised as part of the day to day activities within the

site, but as a separate entity, and is also sited away from the view of the public, thus accounting for it being constructed within a different, and less aesthetic manner than the rest of the stabling on site.

The stabling at the [redacted] reflects necessary hygiene requirements from such a yard, where a large number of unfamiliar and unknown horses are housed in relatively close proximity, either for part of a day, to a number of weeks for the longer term patients. The utilisation of brick and tile throughout, with timber only utilised for doors and related frames, and window frames allows for thorough disinfection to be undertaken, which would be practically restricted within a timber construction, and also in terms of building longevity regarding the intensive cleaning methods utilised.

The most recently constructed yard, at [redacted] exhibits the use of brick throughout, and also the use of zinc to match the adjacent Rotunda building roof.

6.1.8. Fixtures and Fittings

The only best practice criterion which was constant across virtually all case study sites was with regard to water provision. The case study sites exhibited a constant water provision utilising either an automatic waterer or the use of a plastic or rubber bucket manually filled and maintained.

The exception to the above being at [redacted] within the original stall area (which is no longer utilised) where no water provision was located. This may be explained by Glendinning and Wade (2008) with regard to horse ponds being positioned within agricultural holdings for watering and washing the horses, thus water within the stable or stall not being provided, but the horse physically taken to water at certain times of the day. This does not adhere to current management practices, but was common practice previously. However it is very easily remedied by the use of a manually filled water bucket in each stall.

The use of fixtures and fittings varies greatly across the sites and to a certain extent reflects the professionalism of the yard, though this is impossible to quantify or qualify, and thus is recognised as a personal reflection on the sites studied. It can also be concluded that across the sites studied the sites utilised for commercial use tended to

have a greater number of fixtures and fittings, thus reflecting the increased efforts to reduce the workload required to maintain the horses than the more leisure based sites.

[redacted] utilises swinging feed mangers in the front wall of the stables thus reducing the need for personnel to actually enter the stable and put either a feed bucket on the floor or to put feed into a manger within the stable. Automatic waterers are also present to reduce the need for water buckets to be manually filled and cleaned and provides a constant fresh water supply as described as necessary by Hinton (1978) and the AAEP (1995) which is specific to the working horse but can be attributed to quality water provision for any horse.

[redacted] stallion stables exhibits the most extensive example of fixtures and fittings within the cases studied. The stallion stables each contain two boxed in corner mangers with either steel sheet on the wall behind or a large white tiled area. This allows for cleaning and also prevents the stallion chewing the area around the manger. The corner mangers are fully boxed in below, preventing the horse becoming trapped under the manger. The use of the steel manger is in contradiction to Miles (1844) who states that wooden mangers are preferable to metal as by implication iron and steel mangers are cold. The use of the manger not being the horse's natural feeding position is commented on by authors such as Barton (1937) and also previously by Goldschmidt (1928) who states that though the manger should be boxed in preventing the horse being trapped, they are unsuitable and should not be utilised at all.

The yards where mangers were utilised corresponded largely to the yards where automatic waterers were utilised, including [redacted] This again reflects the need to reduce workload but maintain welfare.

The use of the hayrack is limited, reflecting the views of both Barton (1937) and the Pony Club (1988) that the hay rack is not positively viewed because of the unnatural feeding position it produces [redacted] utilises hay racks in the traditional stalls area (1935), reflecting the common design of the time for stalls with a lower trough and upper hay rack running the full length of the building, divided by the use of the stall partitions between each horse Peters (2003).

In contrast, the stallion stables at the [redacted] still utilise hay racks; metal grill hay racks rather than traditional timber racks. This does result in the horse eating from an upright head position rather than the more natural position with the head downwards towards the floor, but does prevent hay being wasted by mixing on the floor with bedding and thus being discarded by the horse. Winter (1846) and also Wheeler (1871) describes the problem with hay racks to include hay seeds falling into the horses eyes and causing blindness, thus being highly undesirable.

Further fixtures and fittings include a variety of tie rings for tying up the horse, and also a hay net. Authors including Houghton Brown and Powell Smith (1989) and the Pony Club (1989) prescribe the use of tie rings, and Scotts (2009) state that they are included as standard within the design of their stables.

A number of case study sites had an alternative method to tie and secure the horse whilst they were in stalls [redacted] have retracting leather lead straps rather than lead ropes set at approximately horse chest height into a wall plate. This enables the horse to be tied securely but still move forwards and backwards without a lead rope causing injury. This is a more sophisticated method than the use of a rope and tie ring as seen at: [redacted] and described by Peters (2003). Therefore the use of such mechanisms does not detract from Fitness for Purpose, but rather improves it with regard to horse safety – but is not recognised in the DEFRA code.

The majority of the sites studied exhibit the fixtures and fittings referred to by Canning (1991): tie ring; haynet ring, water supply and horse proof electric light switches outside the stable. [redacted] exhibits the use of sliding barriers from stall heel posts as described by Coleman (1897). [redacted] in the first floor stalls area (currently not utilised for stabling) has ornate heel posts with these sliding barriers. These appear unique within any of the sites studied, and were manufactured by Musgrave and Bros who by the mid 1800's were manufacturers of patented stable and cattle house fixtures and fitting (CIBSE Heritage Group, 2012).

6.1.9. Floors

Flooring construction was constant throughout all the case study sites; being concrete throughout; with varying degrees of roughening and grooving within the surface, and also the degree of fall across the stable, generally depending on the provision of drainage externally to the stable. There were two case study sites which exhibited additional specific features with regard to flooring; [redacted]

[redacted] exhibits stable flooring which has been put down over time and has a varying consistency in terms of the concrete makeup and also the topography of the surface. A number of the stables also have a noticeable up and over step into the stable, in some cases to prevent water ingress from the external yard, but this also prevents liquid from flowing out of the stable. This step, combined with the varying floor topography does not adhere to McBane (1992) describing concrete as being a less than suitable flooring material, and also the specified central drains (McBane, 1992) not being apparent.

Powell (1991) describes stall floors as ideally sloping to the rear of the stall (the corridor end) which is not always practical in the case of a stable, and thus it is stated that as stables became increasingly popular so did the use of a relatively flat floor. In practical terms, stable management rather than design confers Fitness for Purpose at [redacted] Management appears to be undertaken in such a way that quality bedding material and the thickness of the bedding is more than acceptable regarding the absorption of any liquid and thus pooling inside the stables with a step does not occur. The horses are also generally maintained outdoors at pasture, and thus the time in the stable is minimised.

It was concluded that at this case study site the use of a small step to prevent the ingress of yard water greatly enhanced the stable hygiene and welfare of the horse over and above limiting drainage and flow from the stable. Thus whilst it does not comply with the DEFRA code, it is not considered to detract from Fitness for Purpose in this case.

Though [redacted] is a purpose built modern complex, the flooring utilised has not been without problem. Areas within the yard have utilised concrete which was specially

selected to reduce slipping, but which has proven to be slippery, for both horse and personnel health and safety. This has been reviewed and is considered to be a design specification failure. This has been rectified by the use of an alternative concrete product. Also, the farriery workshop has a specially installed wood block floor area where the horses were tied whilst being shod. This was polished by the construction contractors in the fashion of a domestic wood block floor, which was subsequently deemed unsuitable for the horses as it was slippery; a machine was utilised to remove the polish and roughen the top surface of the wood blocks to deem them non-slip. This is also considered to be a specification failure. This is a unique flooring system not seen elsewhere during the study, and reflects the only wooden floor in evidence. Though this is especially for farriery work rather than general stable flooring, wooden flooring was referred to by Worsley (2004) but this appears to have been plank flooring rather than blocks, which became obsolete in the 17th century.

A number of the sites utilise rubber matting either across the whole of the stable floor, for example at [redacted] and also just inside the stable between the door and the bedding which is a little way inside the door, for example at [redacted] The matting observed throughout all of the case study sites was black in colour. This contradicts the conclusions of Hall and Cassaday (2006) concerning horses being reluctant to walk/step onto black flooring, and that a more naturally occurring colour matting may be preferable.

6.1.10. Drainage

The inclusion and relevance of drainage information within the literature reflects an apparent reduction over time of the importance of quality drainage, but this may also relate to the fact that at the time of writing Cox (1871), Winter (1846) and also Worsley (2004) with reference to stabling of the 1600's would largely have been relating to commercial stabling, the majority of which would have been within an urban and/or city environment, possibly including pit ponies underground and also large stabling installations for commercial horses stabled over a number of floors, and thus drainage may have been perceived as being of greater importance than today when horses are more leisure related; stables instead of stalls, greater space and also that they may be outside the stables for a greater proportion of time at pasture than the historical horses.

The literature also implies that a lesser importance is implied to drainage over and above matters such as ventilation and also dust (due to feed and bedding) since there is a notable lack of peer reviewed experimentation, evaluation and literature on this specific subject.

The drainage provision assessment produced a wider variance of quality than the flooring construction, whereas it could be expected that the two factors would correlate. This may relate to the historic literature (Winter, 1846., Cox, 1871., Birch 1883) being in greater detail regarding drainage than more recent texts, and also the more recent emergence of the importance of drainage to the health of the horse. Worsley (2004) describes stable drainage being apparent as early as the 1600's, thus emphasising its importance in even early buildings. Cox (1871) describes drainage as being pertinent to horses health, and that drainage should be assisted by the use of sloping shallow gutters. Winter (1846) describes the use of a central drain within each stable and more recently McBane (1992) describes the need for suitable drainage, but is not very specific about the specification. Warth (1997) is one of the most recent authors to consider drainage requirements, being simply a two inch (50mm) fall across a roughened concrete stable floor of approximately 3.6m. This equates to a fall of approximately 15mm per meter.

The majority of the yards studied had drainage in the form of a slightly sloping floor to the front of the stable, so that liquid could flow from the stable into the yard. it is not possible to ascertain the falls during the case study visits. There was little evidence of drainage channels or gutters across floors except at [redacted] where, in the original stalls sloping grooves towards the rear of the stalls allowed liquid to flow into the central walkway corridor behind the stalls. There was also a metal covered grill over a deeper drainage channel behind the stalls to take the liquid out of the building, which was semi-covered by a timber sleeper to prevent both bedding moving into the corridor and to prevent bedding blocking the drain, but not impinging on the liquid removal effectiveness.

The most common drainage provision appears not to relate to liquid flowing into a drain, but onto the yard, and into either a grassed area or a central drainage grill elsewhere within the yard. These methods were utilised at the majority of the yards, with both

[redacted] having drainage systems to allow for flow from the first floor to the ground floor. Both of these yards also had a manure removal system to allow easy removal of waste from the first floor to the ground floor; [redacted] hatch and conveyor system to a compaction unit.

6.1.11. Doors

[redacted] definitively do not meet the DEFRA (2006) criteria with regard to stable doors; [redacted] demonstrating four stables where the doors open inwards, not outwards. This is contrary to Canning (1991) stating that stable doors should open outwards to allow ease of access to the stable at all times, including should the horse become cast inside the stable and require emergency assistance, which could be difficult if the door opens inwards.

[redacted] was the only site to utilise gates, instead of traditional stable doors as described by Goldschmidt (1928) and Canning (1991). The gates did match the construction of the internal stabling, and allowed for the large [redacted] occupants to enter and exit the stables safely, and were of a solid construction, providing an alternative to the traditional design. However in an evaluation of Fitness for Purpose these gates, whilst they could be considered overall not to detract from Fitness for Purpose, the lack of security features as described below, determines that they are considered not Fit for Purpose.

There were also a number of stables with stable doors with only top bolts and no bottom bolts [redacted] thus reducing security; and a number of external stables without top doors, thus preventing additional protection in inclement weather. The lack of an additional bolt was not reported as a non-compliance issue, since it is the overall security of the door that should be evaluated.

The lack of a top door was not considered a non-compliance issue as its provision was not mandatory within the Code. When top doors were provided it was considered that this enhanced the horses welfare. In the majority of the case studies the lack of a top door was compensated by the weather protection provided by the site locally.

6.1.12. Roofs

[redacted] was the only case study site which had a traditional hay loft above what was once utilised as traditional farm horse stalls, though the stalling is no longer present, and the space is currently utilised for storage. Peters (2003) suggests that lofts above stabling provided additional insulation but that ventilation may be restricted, a factor also stated by Glendinning and Wade (2008).

[redacted] has a loft space above the thatched stables, but this was an open area utilised for general storage and not hay.

Case study sites which exhibited a first floor or subsequent floors but not traditional hay lofts were [redacted] with the upper floor utilised for general storage, in a similar fashion to [redacted] has what was once personnel housing on the first floor, as has the [redacted] though the staff accommodation at the [redacted] is still utilised. [redacted] has stabling on both the ground and the first floor, with an internal ramp for access and additional storage space on the third and fourth floors above, in a similar fashion to [redacted] which has yards on the ground and the first floors, and an external ramp for access.

As described above, [redacted] was the only site studied with a thatched roof, the decline in the use of thatch being noted in Blundevil (1565), and thatched stables being a rare occurrence today, as described in 3.1.2.

Overall the roofs at all sites provided the requisite protection from the weather and did not detract from ventilation, thus all being deemed compliant with Fitness for Purpose criteria.

6.1.13. Light, and Windows and Ventilation Slats

Ventilation, perceived by many of the authors referenced within the literature review as one of the most important factors concerning stable design and equine health appears to have been addressed with varying levels of attention within the case study sites. Murray *et. al.* (1996) refers to the importance of quality ventilation provision on the horse's respiratory tract, as does Clarke (1997) and Webster *et. al.* (1987) who both include ventilation within the holistic concept of air hygiene.

However, air hygiene and management practices to enhance hygiene are commented on by Flemming *et. al.* (2008), Hessel *et. al.* (2009) and Garlipp *et. al.* (2010) and whilst relating specifically to dust it is largely an area beyond the remit of this thesis.

Peters (2003) describes physical draft free ventilation mechanisms including shutters, louvres and ventilation slits being utilised as early as the mid nineteenth century. Powell (1991) also describes the use of window vents and roof ridge vents and Worsley (2004) describes the use of oeil-de-boeuf windows being ideal for additional ventilation. These ideals concerning ventilation are in contrast to the management practices commented on by John Lawrence (1796) that it was still fashionable to keep horses too hot and neglecting the air within the stables. He also suggested that it was commonly accepted practice for grooms to block any ventilation provision or even a small crack in the wall to prevent air escaping, which is in total contrast to works published in the 1800's by Miles (1844) and Haycock (1869) who commented on the importance of the relationship of stable design to horse health, including the importance of ventilation.

Case study sites include a variety of lighting and ventilation provisions; [redacted] incorporates the use of Yorkshire (spaced) boarding, windows and ventilation within the roof in both converted buildings and also new built sectional stabling, as do many of the other case study sites. Traditional windows with a lower hinge opening the upper section of the window inwards as described by Brock (1937) and still considered to be best practice were apparent within many of the older stable buildings studied including [redacted] Louvred plastic ventilation windows appear commonly within timber sectional stabling and were present within a number of the yards which utilised timber sectional stabling. However, the [redacted] which is a relatively newly constructed sectional timber yard does not have any windows; though it could be expected to see louvred windows. Both the veterinary yards studied, [redacted] utilise plastic louvred windows. At the [redacted]; to the front of newly built brick stables utilised for day patients, and at [redacted] within the timber sectional stabling; highlighting the importance of ventilation even where the risk of disease and contamination is of high priority.

A number of the yards also utilise mechanical ventilation systems [redacted] has a similar system which is enhanced further by the use of a number of large fans to assist air flow. [redacted] has a ventilation system and unlike the previously two mentioned yards has a large number of windows to enhance ventilation and natural light further.

The yards which have the additional mechanical ventilation systems are the three yards with the most compact footprint, though [redacted] does have a large outside parade ground area and the area is also the most central of the London sites studied, with the exception of the [redacted]

[redacted] exhibits the most extensive lighting and ventilation provision; every stable building having automatic window vents in the roof to provide good quality upwards air flow and circulation without causing drafts across the horse's backs. In addition each stable and stall has a barred window to the rear (without glass or plastic panes), with timber shutters which remain open except during inclement weather. This ventilation is increased further, by open doorways into the main service corridor and double stable doors at the opposite ends of the yards where the upper sections remain open when weather permits to increase air flow.

The level of natural light provided across the sites studied varied from no natural light provision (except via the upper part of the stable door) to extensive traditional leaded windows and ornate oeil-de-boeuf windows, and non-paned windows with metal bars and opening timber shutters. One site also included the use of lantern lights as described by Powell (1991) within a small yard in Walton-On-Thames, though these are now electric and do not make use of a naked flame.

[redacted] has a mixed provision of natural light, with glass paned windows on the ground floor, which due to the location are secured shut as they would provide direct access from the pavement, which would be unsuitable for the safety and welfare of both horses and personnel. On the first floor the stable area has opening oeil-de-boeuf windows to provide both light and ventilation, but the stalls area does not have any windows, relying on light from the central glass roofed atrium to provide limited natural light. The central atrium also lights the walkway and ramp from the ground floor to the

first floor, and the central ground floor working area which is utilised for both storage and routine horse care such as farrier and saddler visits.

[redacted] does not have windows. This is unusual given the relatively recent development of the yard, and the timber nature of its construction. This does correlate with the works of Coleman (1897) regarding harsh light causing “shiers” but this does not conform to modern best practice.

[redacted], in both the stabling and the traditional stalls areas has no windows. The stalls area is only lit by the doorways at the ends, and mid-way along the building along one side, though the extensive use of white paintwork increased the effect of the minimal light entering the building. The stable area does not contain windows, but the buildings are part Yorkshire boarded along each side, therefore providing an alternative method of light entry rather than via a traditional window.

[redacted] exhibited the most limited case study site in terms of natural light; on the ground and first floors due to an enclosed corridor forming a walkway into each yard at one end, and only a wide open stable door onto an external corridor at the other end. The doorway was open, except for a metal bar to contain a loose horse, but provided the only source of natural light for the whole yard This is in contrast to Warth (1997) who describes the stable as requiring good natural light, which is clearly not the case within this case study site.

[redacted] also had relatively restricted natural light within one stable, one of the original thatched stables as there was no window to the front, and in this case no window to the side of the stable either. The adjoining stable had a side window, but this couldn’t be the case in both stables as one stable is adjacent to a storage room and not an external wall. The top stable doors remain open at all times to allow as much natural light as possible to compensate for the limited window facility. In contrast, the new timber sectional stables have numerous windows, and demonstrates that management appreciate both ventilation, light and social contact. Each stable has a closed window to the front, a traditional stable door to the front, with the top door open, the same to the rear of the stable, the left hand stable has a large open window with a shutter and there is also a grill between the stables to enable additional light and also social contact

between the occupants. This displays aspects referred to by Warth (1997) regarding health and well being.

[redacted] provides each horse with a grilled and shuttered window opening at the back of its stable or stall, allowing for ventilation and natural light, which is increased further by roof lights, and also large double half doors at the end of the barns, thus providing a light and airy accommodation complex.

6.1.14. Stalls v Stables

Stables alone were evident at eleven of the sites, with stalls being evident alongside stables at the other sites (7 Nr), therefore no site containing stalls alone. Even where stalls would have been the only provision in the past, stables have subsequently been incorporated. It was evident that where stalls were still utilised these sites were of an urban nature and utilised for commercial horses, and not leisure horses.

Stalls do not form a part of the DEFRA code. However, the following data is presented since stalls form a significant proportion of commercial horse accommodation. 6/11 (55%) of the commercial case study sites still utilise stalls. 1/7 (14%) of non-commercial case study sites utilised stalls although this was to provide visitors with an illustration of the past.

This relates to Peters (2003) who states that by the late 18th and early 19th century horses in lighter work were more commonly kept in stables rather than stalls, thus referring to working horses rather than leisure horses being managed continually in stalls.

Unlike Powell (1991) there were no differences identified between the sizes of the stalls within each case study site, which suggests that the horses within each site were all being maintained for the same use, and therefore no need of differentiation between the stall sizes. Powell (1991) stated that throughout, and post the Victorian era stalls became less popular than stables. This is reflected within six of the study sites, where stables have now been incorporated within an original stall design.

[redacted] both historic stalling and also a small number of modern sectional stables where stalls once stood. [redacted]

has been modernised in a similar fashion with both traditional stalling and newer sectional stabling being present. [redacted] exhibits traditional stalling for visitor interest though it is no longer utilised, modern gated stabling within a modern barn being used instead. At the [redacted] ornate stalling has been incorporated into stabling, thus two stalls forming one stable. [redacted] has some historic stalling, but is predominantly sectional stabling which can be altered easily due to the specific unique nature of the sectioning into stalls when necessary. [redacted] is unique in that traditional stalling for agricultural horses can be identified, though the partitioning is no longer in evidence and the building is now utilised for storage, not horse accommodation. Since a significant proportion of the commercial case study sites still utilise stalls, this issue will be returned to in the recommendations section of the final chapter.

6.1.15. Stable Size

Canning (1991) states that the dimensions for a hunter (large horse) should be a minimum of 12 x 14 feet (approx 3.65 x 4.20 m), with a pony stable being 12 x 12 feet (3.65 x 3.65m). Horse and Rider (2009) state that the minimum stable size must be 12 x 12 feet (3.65 x 3.65m), and larger for a big horse, but do not specify what is considered to be “larger” or a “big” horse. Canning (1991) therefore agrees with DEFRA (2006) regarding the size of stable for a hunter, being a large horse, but the stated criteria for a pony are equal to that of a horse in DEFRA (2006). Horse and Rider (2009) agrees with Canning (1991), that a horse, and smaller is adequately housed in a 3.65 x 3.65m (13.30m^2), but a large horse would require greater space.

However Powell and Jackson (1992) consider the minimum requirements to be smaller than Canning (1991) and Horse and Rider (2009), and also DEFRA (2006), therefore disputing the minimum welfare requirements as previously stated. No explanation for the discrepancies was provided by the authors. The subsequent analysis therefore used the predominant sizes for analysis.

Most horses roll before rising within a small stable to reduce the chance of getting stuck against the stable walls. This brings in to question the Fitness for Purpose of the suggested stable sizes stated in modern management literature. Pedersen *et. al. (*2004)

recommends that each stable wall should be twice the length of the horse, with a minimal recommendation of at least 3.2m x 3.5m or larger required (Pedersen *et. al,.* 2004).

Raabymagle and Ladewig (2006) recommend that the shortest wall of a stable is at least 1.5 times the height of the horse at the withers, and that the footprint must be at least twice the height at the withers squared.

For a 16.2hh horse:

1.5 x withers height = 8 feet 3 inches	2.51 meters	Length of shortest wall
$(2 \times \text{withers height})^2 = 121 \text{ feet}^2$	11.20 meters^2	Minimum area

As described above, a horse has been evaluated at being 16.2hh and under; thus 9 nr study sites (50%) did not exhibit all stables achieving a minimum size of 3.65 x 3.65m as required for a horse, this includes all the study sites utilising stalls. No study site exhibited all stables being the required size of a minimum of 3.65 x 4.25m suitable for a large horse. Stables were recorded with walls at, and exceeding 4.25m in length, but these stables had adjoining walls of shorter than 3.65m length.

The sizes of the study site stables is discussed in detail later in this chapter, relating to the referenced works described above.

6.1.16. Social Interaction and Free Exercise

Research undertaken at the University of Aarhus, Denmark concluded that the horse "preferred" physical contact with other members of their species and this has influenced the regulatory policy decision of the Danish Ministry of Justice regarding horse ownership; that horse keepers must have at least two horses, therefore defining the need for horses to have the opportunity for social interaction (Specialequinesearch, 2007). Horsetalk (2007) describes sniffing, nuzzling and rubbing as required physical contact behaviours. Jansson, *et. al.*, (2008) defines paddock provision and management, rather than stable provision, recommending that horses receive no less than 3 to 4 hours in a paddock daily, 1 hour being an absolute minimum, which still leaves 20 – 23 hours per day in the confinement of a stable to exhibit social interaction behaviour.

Fitness for Purpose social interaction provision was recorded as being achieved if as a minimum horses were able to exhibit social behaviours with another horse whilst in their own stable. This varied between horses being able to exhibit behaviours with a neighbour, or a horse stabled opposite. There were no study sites utilising group housing.

All sites with utilised stalls were non-compliant with regards to social interaction, partly due to the use of stalls resulting in the occupant being unable to see, and certainly reach a neighbour, and being unable to see a horse opposite as the occupant was positioned with the head towards the wall, and not towards a horse which may be opposite it.

Study sites with free exercise provision were reviewed at Nr 9 (50%) of the study sites. This is equal to the number of sites demonstrating social interaction opportunities.

Sites demonstrated a variety of free exercise facilities; from traditional paddocks and fields, to utilising a central courtyard area for short term loose exercise, with the provision of a plastic treat filled play ball to stimulate the exercise time further.

6.2. Positive Attributes Analysis

The positive attributes as specified by the Code of Practice (DEFRA, 2006) and relevant authors (Borsheim, *et. al.*, (2008); Harewood and McGowan (2005); Kiley-Worthington (1997a); McBane, (1992); McGreevy *et. al*. (1995); Nagy *et. al.* (2008); Rose – Meierhöfer *et. al.* (2010); Specialequinesearch (2007); Werhahn *et. al.* (2011) and Winther Christensen *et. al.* (2002).) were disaggregated against the number of horses stabled at each site (numbers taken from the site being at full capacity). This is categorised into fewer than 30 horses, 30 to 80 horses, and over 80 horses as illustrated in Table 6.8.

Table 6.8. Percentage Compliance Against DEFRA (2006) and Social Interaction and Free Exercise Criteria Disaggregated by Number of Horses

Number of Horses	Construction	Fixtures and Fittings	Floors	Doors	Roofs	Light	Windows and ventilations slats	Size Horse	Size Large Horse	Stalls	Social Interaction	Free Exercise
Fewer than 30	100	100	100	71	100	86	29	43	0	43	43	57
Over 30 Under 80	100	100	100	100	100	86	71	71	0	29	29	43
Over 80	100	100	100	100	100	100	75	25	0	75	75	25

Table 6.8. indicates that sites with Under 30 horses generally exhibit poor ventilation provision, with under 30% (2 Nr) of the sites reaching the required minimum standard.

Sites with Over 30 Under 80 horses exhibit the highest incidence of stables which meet the required criteria with regard to size (Horse) (5 Nr).

No sites meet the required criteria with regard to size (Large Horse) (18 Nr).

Sites with Over 80 horses exhibit the highest percentage of the use of stalls, with 75% of the sites containing stalls (3 Nr).

The data in Table 6.8. demonstrates that the use of stalls and the level of social interaction is identical for sites with over 30 and under 80 horses, indicating that smaller sites, and larger sites provide a greater level of social interaction than those housing between 30 to 80 horses.

Table 6.8. also indicates a decline in Free Exercise as the number of horses housed at a site increases, thus horses at a site with over 80 horses only have a 25% opportunity for free exercise (1 Nr), whilst horses housed at a site with under 30 horses have twice as much opportunity (5 Nr).

The positive attributes were similarly disaggregated against the age of the stables on each field study site, (recorded as the earliest stabling on the site) and then categorised as: pre 1900; post 1900 to pre 1980; and post 1980, illustrated in Table 6.9.

Table 6.9. Percentage Compliance Against DEFRA (2006) and Social Interaction and Free Exercise Criteria Disaggregated by Age of Stables

Age of Stables	Construction	Fixtures and Fittings	Floors	Doors	Roofs	Light	Windows and ventilations slats	Size Horse	Size Large Horse	Stalls	Social Interaction	Free Exercise
Pre 1900	100	100	100	83	100	83	67	50	0	50	50	17
Post 1900 pre 1980	100	100	100	88	100	100	100	38	0	38	38	75
Post 1980	100	100	100	100	100	75	100	75	0	25	25	25

Table 6.9. indicates that all sites Post 1980 have stable doors which meet the specified criteria, whilst sites Pre 1900, and Post 1900 - pre 1980 are inadequate at 20% of sites (2 Nr), demonstrating an improvement in the use of doors in developments since 1980.

The use of natural lighting improved between Pre 1900 and Post 1900 – pre 1980 sites by nearly 20%, but declined in Post 1980 sites.

Ventilation provision was poorest in sites within the Pre 1900 category, with a clear improvement to 100% of sites reaching the required standards during the Post 1900 – pre 1980 category, which was maintained into sites dating from 1980.

Stable size reduced between Pre 1900 and Post 1900 – pre 1980 sites, but increased significantly in Post 1980 sites, demonstrating an improved understanding of the importance of stable size to the welfare of the occupants.

The use of the stall demonstrates a continuous percentage decline between Pre 1900 (2 Nr) and Post 1900 – pre 1980 sites (4 Nr), a trend which continues to Post 1980 sites (1 Nr)

Table 6.9. also indicates a decline in the opportunity for Social Interaction, with a 50% reduction between Pre 1900 sites (4 Nr) and Post 1980 sites (3 Nr).

In contrast, the opportunity for Free Exercise has increased over time, significantly between Pre 1900 (1 Nr) and Post 1900 pre 1980 sites (6 Nr), and then reducing again Post 1980 (2 Nr), but remaining at above Pre 1900 levels.

The positive attributes were similarly disaggregated further against the type of horse housed at the field study site (not the sites commercial, or otherwise status); thus into commercial and non-commercial horses, as illustrated in Table 6.10.

Table 6.10. Percentage Compliance Against DEFRA (2006) and Social Interaction and Free Exercise Criteria Disaggregated by Type of Horse

Type of Horse	Construction	Fixtures and Fittings	Floors	Doors	Roofs	Light	Windows and ventilations slats	Size Horse	Size Large Horse	Stalls	Social Interaction	Free Exercise
Commercial	100	100	100	100	100	82	64	27	0	55	45	36
Non Commercial	100	100	100	71	100	100	57	57	0	14	100	57

Table 6.10. indicates that commercial stabling demonstrates inadequate lighting provision in a significant number of sites (2 Nr), whilst non-commercial stabling demonstrates an inadequate door facility at a significant number of sites (2 Nr).

Both commercial and non-commercial sites demonstrate a similarly poor level of window and ventilation slit provision (4 Nr and 4 Nr respectively), demonstrating that the ventilation provision is frequently inadequate regardless of the type of stable inhabitant.

Parallels are exhibited between the size of the stable (horse) and the use of stalls, with commercial sites demonstrating the use of inadequately sized stables (Horse) (6 Nr), and a higher incidence of stalls (5 Nr). In contrast, non-commercial sites exhibit a higher level of stabling which does meet the minimal requirements regarding stable size (horse) (4 Nr) and a lower incidence of the use of stalls (1 Nr).

Table 6.10. indicates that commercial horses have limited opportunity for both Social Interaction (6 Nr) and Free Exercise (7 Nr).

Non-commercial horses have a greater opportunity than commercial horses for both Social Interaction (7 Nr) and Free Exercise (5 Nr).

Data was further analysed concerning stable size; floor area (m^2) and wall length (m). This was analysed separately for each category within Tables 6.11., 6.12., 6.13., 6.15., 6.16., 6.17, 6.19. and 6.20.

Data was disaggregated against number of horses; fewer than 30 horses in Table 6.11, 30 to 80 horses in Table 6.12. and above 80 horses in Table 6.13.

Table 6.11. Analysis by Size of Stables and Number of Horses:

Fewer than 30 horses (7 Nr)

Size Range	DEFRA Minimum	Minimum	Maximum	Mean	Median	Mode
Floor Area (m^2)	13.37	9.00	15.35	10.81	10.26	9.00
Wall Length (m)	3.65	2.85	5.00	3.25	3.15	3.00

Table 6.11. demonstrates that stables at 4 Nr study sites with fewer than 30 horses (Total = 7 Nr) did not meet the required minimum size for a stable (horse) with the minimum floor area of 9.00 m^2 being less than the specified 13.37m^2 for a 12 x 12 feet (3.65 x 3.65m) stable.

There were no sites that met the minimum required floor area size of 15.60m^2 for a large horse; 3.65m x 4.25m (12ft x 14ft).

The mean floor area of 10.81m^2 does not meet the requirement for a horse (13.37m^2), or for a large horse (15.60m^2).

The median and mode floor area calculations indicate that where fewer than 30 horses are stabled, the most commonly occurring floor area is the minimum recorded within this sample (9.00m^2), the median figure being towards the minimum stable size indicating that though the maximum stable size was 15.35 m^2 the majority of the stables were towards the minimum size, rather than the maximum size.

Table 6.11. demonstrates a variety of stable wall lengths within the study sites; the longest being two meters longer than the shortest wall. The mean indicates that the maximum wall length was in the minority, the mean being closer to the minimum wall length. This is indicated also by the median figure of 3.15m, being just over the minimum wall length. The mode of 3.00m confirms this, establishing that the most common wall length is little more than the minimum, even though a wide range of wall lengths was recorded.

Table 6.12. Analysis by Size of Stables and Number of Horses:

30 – 80 horses (7 Nr)

Size Range	DEFRA Minimum	Minimum	Maximum	Mean	Median	Mode
Floor Area (m^2)	13.37	9.00	21.17	11.78	13.05	9.00
Wall Length (m)	3.65	3.00	5.40	3.70	3.65	3.00

Table 6.12. demonstrates that 2 Nr stables at study sites with Above 30 – below 80 horses (Total = 7 Nr) did not meet the required minimum size for a stable (horse) with the minimum floor area of 9.00 m^2 being less than the specified 13.37m^2 for a 12 x 12 feet (3.65 x 3.65m) stable.

The maximum floor area (m^2) of 21.17m^2 was in excess of the minimum required for a large horse. This is 5.57m^2 larger than the specified requirement of 15.60m^2.

The mean floor area of 11.78m^2 does not meet the requirement for a horse (13.37m^2), or for a large horse (15.60m^2).

Tables 6.11. and 6.12. demonstrate similar median and mode trends; that the most commonly occurring stable size is the smallest found at the site, and that the median is considerably smaller than the maximum size, though in Table 6.12. the median is greater than the mean, which is contrary to Table 6.11, indicating that there are a number of larger stables found within these sites, though the most frequent stable size is still 9.00m^2.

Table 6.12. demonstrates that stable wall length varies by 2.40 meters within the 30 – 80 horses sites studied. The mean demonstrates a greater frequency of the walls towards the lower end of the wall lengths recorded, rather than the greater lengths. This is concluded also by the median figure, which is similar to the mean, and also that the most frequently occurring wall length is 3.00m, the shortest recorded.

Table 6.13. Analysis by Size of Stables and Number of Horses:

Above 80 horses (4 Nr)

Size Range	DEFRA Minimum	Minimum	Maximum	Mean	Median	Mode
Floor Area (m^2)	13.37	9.52	19.42	11.78	12.88	12.90
Wall Length (m)	3.65	2.80	5.10	3.71	3.95	4.00

Table 6.13. indicates that 3 Nr stables at study sites with Above 80 horses (Total = 4 Nr) did not meet the required minimum size for a stable (horse) with the minimum floor area of 9.52m^2 being less than the specified 13.37m^2 for a 12 x 12 feet (3.65 x 3.65m) stable.

The maximum floor area (m^2) of 19.42m^2 did meet the required minimum size for a stable (large horse) with the floor area being significantly greater than the specified 15.60m^2 for a 12 x 14 feet (3.65 x 4.25m) stable.

The mean floor area of 11.78m^2 does not meet the requirement for a horse, or for a large horse.

Table 6.13. demonstrates that the minimum stable floor area was greater than in Tables 6.11. or 6.12; thus that horses within a larger stabling environment had greater minimum stable sizes. Table 6.13. demonstrates that this category had a greater median than Fewer than 30 Horses, but less than 30 – 80 Horses.

The mode being 12.90 m^2 was greater than in Table 6.11. or Table 6.12; horses at sites with Above 80 Horses having the greatest opportunity to be housed in a stable greater than the minimum on site, and the minimum being greater than in Tables 6.11. and 6.12.

Table 6.13. also demonstrates a difference of 2.30m between the shortest and longest walls recorded. The mean is less than the mid point between the shortest and longest walls, indicating that the majority are towards the shorter length. The mode is exactly at the midpoint between the minimum and maximum wall lengths indicating a consistent distribution of wall lengths across the recorded sites. The mode indicates that the most frequently occurring wall length was considerably (1.20m) greater than the shortest, an almost identical figure to being shorter than the longest wall (1.10m) indicated by a steeply kurtosic distribution.

The data demonstrates that there is a large variability of stable sizes within each category. The mean floor area (m^2) is greater at sites with over 30 horses, and that the mean floor area (m^2) for both the Above 30 – below 80 horses and the Above 80 horse's categories were identical, being greater than for the fewer than 30 category.

Wall length data analysis demonstrated that the 30 to 80 and above 80 categories had almost identical means; being greater than for below 30 horses; thus clarifying the floor area data (m^2).

At only 5 study sites (28%) do the stables exceeded the minimum requirements of Pederson *et. al.*, (2004). with regard to the walls being at least twice the length of the horse for a 14.2HH pony.

Only 2 study sites (11%) had all stables exceeding the Pederson *et. al.*, (2004) minimum requirements for stable walls being at least twice the length of the horse, for a 15.2HH horse.

The 2 study sites that met the Fitness for Purpose criteria (Pederson *et. al.*, 2004). for a 15.2HH horse also met the criteria for a 16.2HH horse.

There were no study sites that met the Pederson *et. al.*, (2004) criteria for the stable wall length being twice the length of the horse, for a 17.2HH horse.

This indicates that the entire sample of the study sites, a valid sample representation of the stables within the South and South East of England do not meet Fitness for Purpose criteria as stipulated by Pederson *et. al.* (2004) with regard to stable wall length.

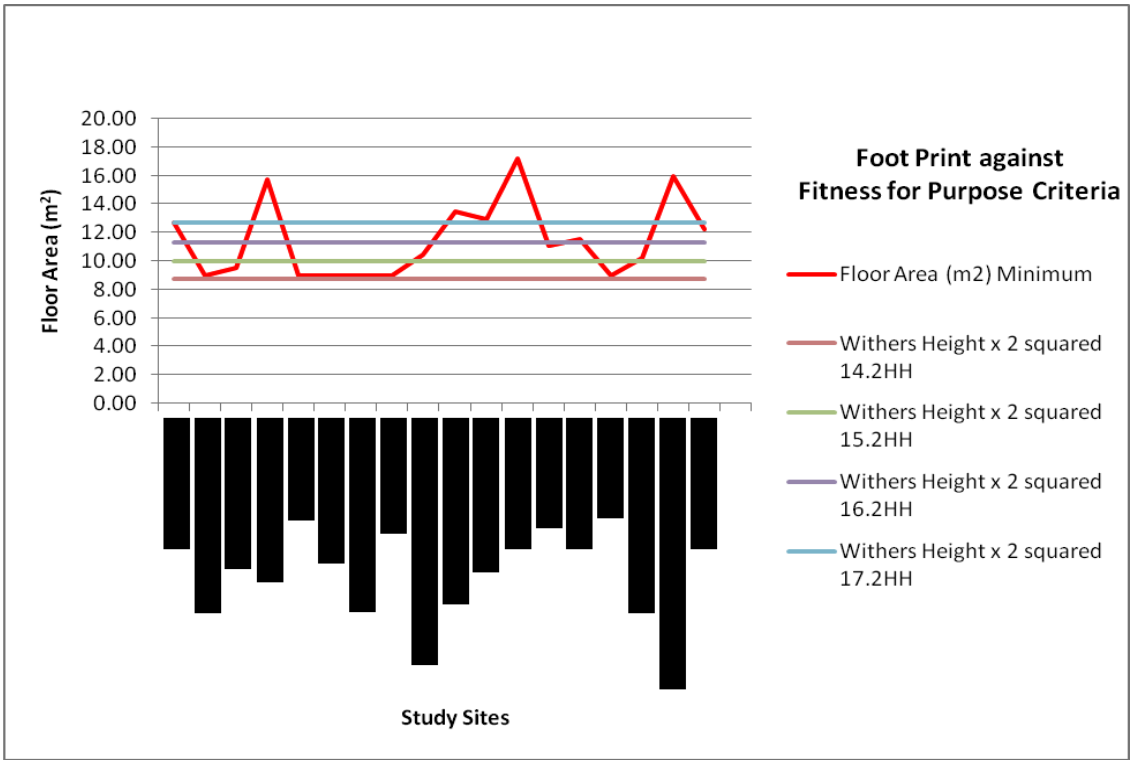


Figure 6.10. Foot print against Fitness for Purpose Criteria

Minimum Stable Floor Foot Print 2 times the Withers Height of the Horse, squared
Raabymagle and Ladewig (2006)

In contrast, the maximum stable size of 24.00m^2, did meet the requirements for a stable (large horse). The maximum sized stables were in excess of double the size of the smaller stables.

The mean floor area is in excess of that required for a stable (horse) but not for a stable (large horse).

The median is approximately half the size of the largest stable, and slightly less than the mean. The mode being equal to the smallest stable, indicating that though the largest stables were considerably larger (in excess of double the size of the smallest stable) the probability of a horse being stabled in a below mean size stable was greater than it being in a larger than mean size stable.

Table 6.15. demonstrates a 3.00m difference between minimum and maximum stable wall length. The identical mean and median of 3.60, and the mode of 3.00, the minimum wall length indicates that though the longest wall length is twice as long as the shortest, the shortest walls are most common.

Table 6.16. Analysis by Size of Stables and Age of Stables:

Post 1900 – Pre 1980 (8 Nr)

Size Range	DEFRA Minimum	Minimum	Maximum	Mean	Median	Mode
Floor Area (m^2)	13.37	9.36	19.42	9.75	11.33	9.36
Wall Length (m)	3.65	2.80	5.80	3.55	3.60	3.65

Table 6.16. indicates that at 5 Nr Post 1900 – Pre 1980 sites (Total = 8 Nr) the smallest stables did not meet the requirements for a stable (horse) being less than the specified 13.37m^2.

The largest stables of 19.42m^2 meet the requirements for a stable (large horse) of 15.60m^2, but the mean floor area of 9.75m^2 is significantly less than the 13.37m^2 specified for a horse.

The mean, median and mode indicate that the maximum floor area of 19.42m^2 is uncommon, with the majority of stables being towards the minimum size, rather than the maximum, indicated by the abnormal kurtosis of the distribution.

Table 6.16. demonstrates that the stable wall length differs by a maximum of 3.00 meters. The mean, median and mode indicate that as above, in Table 6.15 the minority of stables have the maximum wall lengths, the majority being towards the minimum length.

Table 6.17. Analysis by Size of Stables and Age of Stables: Post 1980 (4 Nr)

Size Range	DEFRA Minimum	Minimum	Maximum	Mean	Median	Mode
Floor Area (m^2)	13.37	9.00	12.25	11.88	11.30	11.25
Wall Length (m)	3.65	2.85	4.00	3.40	3.35	3.25

Table 6.17. demonstrates that the Post 1980 stables demonstrate the smallest range of stable size across the Age of Stables category.

The minimum floor area of 9.00m^2 is significantly less than the specified 13.37m^2 requirement for a stable (horse). The maximum stable size of 12.25m^2 also does not meet the requirements for a horse either.

The mean floor area of 11.88 m^2 is significantly less than the specified 13.37m^2 requirement for a stable (horse).

The mean, median and mode are all similar, indicating that there is little variability in the size of stables.

Table 6.17. indicates that stable wall lengths differ by only 1.15 meters, reflected by the similar mean, median and mode figures of 3.40, 3.35 and 3.25 respectively, and the steeply kurtosic distribution.

The overall data from Tables 6.15. – 6.17. defines that the minimum floor size has increased slightly, then decreased slightly over time.

The maximum stable size has decreased over time, with the largest stable in 1980 being approximately half the size of the maximum stable size in the pre 1900 category.

Though there is a significant difference between the maximum stable sizes across the stable age categories, this is not reflected in the mean floor area, which has reduced over time, but not considerably.

Table 6.18. Stalls present relating to Age of Stables

Age of Stables	Number of sites with stalls	
	Number (Total)	%
Pre 1900	3 (6)	50
Post 1900 – Pre 1980	3 (8)	38
Post 1980	1 (4)	25
Total	7 (18)	40

Table 6.18. demonstrates that whilst taking into account the age of the sites, both Pre 1900 (3 Nr) and Post 1900 – Pre 1980 (3 Nr) sites demonstrate an identical number of stalls being present. A single site (1 Nr) in the Post 1980 site category utilised stalls, demonstrating a significant move away from their use in more recent times.

Data concerning the size of stables (floor area m^2 and wall length) was analysed against the type of horse; commercial horses in Table 6.19. and non-commercial horses in Table 6.20.

Table 6.19. Analysis by Size of Stables by Type of Horse: Commercial

Size Range	DEFRA Minimum	Minimum	Maximum	Mean	Median	Mode
Floor Area (m^2)	13.37	9.00	24.00	10.20	9.55	9.00
Wall Length (m)	3.65	2.80	5.10	3.50	3.20	3.00

Table 6.19. demonstrates that the minimum size commercial stable does not meet the requirement for a horse stable, being below the minimum specification of 13.37m^2.

The largest maximum stables of 24.00m^2 do meet the requirements for a stable for a large horse, being significantly in excess of 15.60m^2.

The mean floor area of 10.20m^2 does not meet the requirements for a stable for a horse, being significantly less than the specified 13.37m^2.

The 15.00 m^2 difference between minimum and maximum stable size is not reflected in the mean and median figures, which are towards the minimum stable size, which is reflected also by the mode being equal to the minimum floor area m^2, thus indicating that the maximum floor area is an exception within the study sites.

Table 6.19. also demonstrates a wide variation of stable wall lengths (2.30 meters). The median and mode being greater than the minimum wall length indicates that the shortest wall length of 2.80 meters is the exception, but the mean, median and mode figures being significantly less than the greatest stable wall length indicates that the maximum wall length of 5.10 meters was the exception within the study sites.

Table 6.20. Analysis by Size of Stables by Type of Horse: Non Commercial

Size Range	DEFRA Minimum	Minimum	Maximum	Mean	Median	Mode
Floor Area (m^2)	13.37	9.00	21.17	13.44	11.55	12.05
Wall Length (m)	3.65	3.00	5.80	3.60	3.55	3.60

Table 6.20. demonstrates a varied range of floor areas (m^2), with the largest stable being in excess of double the smallest stable size.

The minimum size non-commercial stable does not meet the requirement for a horses stable, being below the minimum specification of 13.37m^2.

The largest (maximum) stables of 21.17m^2 do meet the requirements for a stable for a large horse, being significantly in excess of 15.60m^2.

The mean floor area of 13.44m^2 meets the requirements for a stable for a horse, being greater than 13.37m^2, but not for the requirements of a large horse, being less than 15.60 m^2.

The mean, median and mode indicate that the majority of stables are within the range 11.50m^2 to 13.50 m^2.

Table 6.20. demonstrates that stable wall length varies by 2.80 meters across the study sites, but that the mean (3.60), median (3.55) and mode (3.60) figures are similar, indicating that the shortest wall length of 3.00 meters is the exception, but also that the longest wall length of 5.80 meters is rare within the study sites.

The data from Tables 6.19. and 6.20. demonstrates that there is no difference between the minimum size of commercial and non commercial stables. The minimum stable size is below that stated as required for a horse.

There is an approximate 3.00m^2 difference in the maximum stable size of the commercial and the non-commercial stable, with the commercial stable having the greater maximum stable size.

In contrast, the non-commercial stable has the greater mean floor area, being 3.24m^2 greater than the commercial stable mean floor area.

Table 6.21. Stalls present relating to Type of Horse

Type of Horse	Number of sites with stalls	
	Number (Total)	%
Commercial	6 (11)	55
Non-commercial	1 (7)	14
Total	7 (18)	40

Table 6.21. demonstrates that stalls are distributed significantly differently between commercial sites (Nr 6 – 55%) and non-commercial sites (Nr 1 – 14%); with only a single non-commercial site (14%) exhibiting the presence of stalls, though these are no longer utilised. Thus 100% of utilised stalls are commercial.

6.3. Social Interaction and Free Exercise Analysis

Social Interaction and Free Exercise data was analysed against the same categories as above regarding stable size data analysis; number of horses; age of stables and type of horse.

Table 6.22. Social Interaction and Free Exercise Provision Compliance: Disaggregated by Number of Horses

Number of Horses	Social Interaction		Free Exercise	
	Number (Total)	%	Number (Total)	%
Fewer than 30	3 (7)	43	4 (7)	57
Over 30 Under 80	2 (7)	29	3 (7)	43
Over 80	3 (4)	75	1 (4)	25

Table 6.22. indicates that sites with over 80 horses have the greatest opportunity for Social Interaction, with 75% of sites within this category having positive social interaction compliance. In contrast, horses at sites with over 80 horses only have a 25% opportunity for Code compliant Free Exercise.

Sites with Fewer than 30 horses have just under 50% and just over 50% opportunity for Social Interaction compliance and Free Exercise compliance respectively, whereas sites with Over 30 and Under 80 horses respectively have significantly less opportunity for Social Interaction compliance (29%) and less than 50% opportunity for Free Exercise.

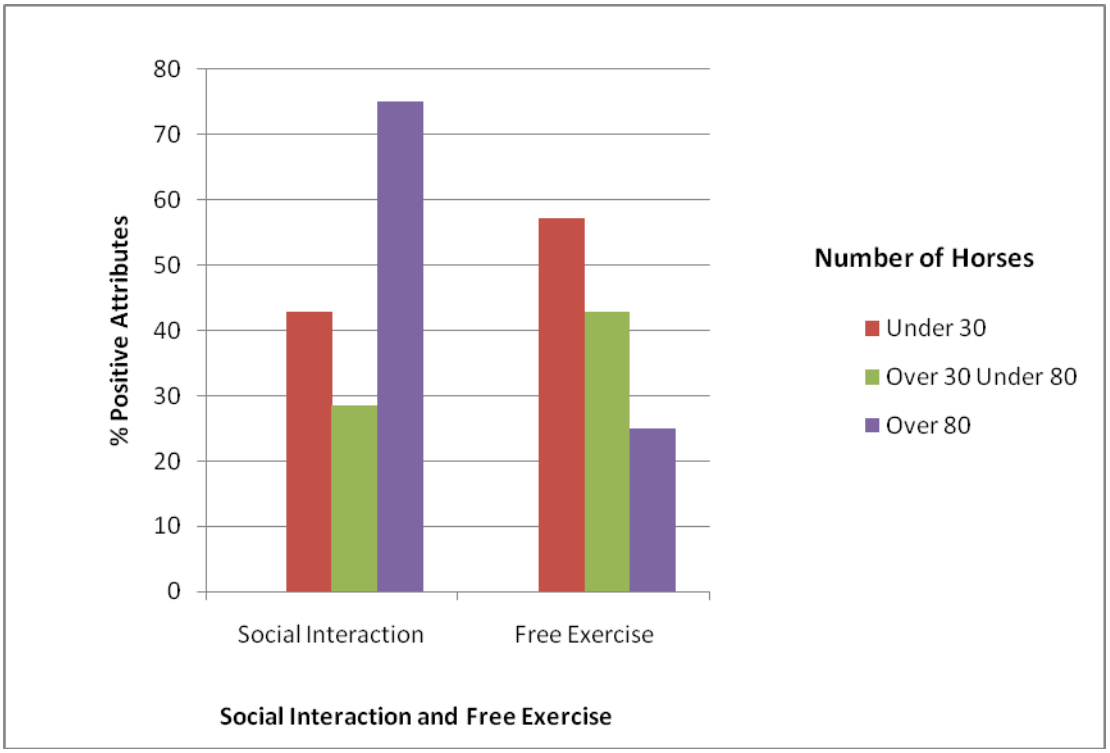


Figure 6.1. Social Interaction and Free Exercise Provision Compliance (%): Number of Horses

Figure 6.1. demonstrates that there is no relationship between Social Interaction and Free Exercise, when disaggregated by the number of horses data.

Figure 6.1. also demonstrates that the sites containing the largest number of occupants (Over 80) have a significantly greater opportunity for the horses to have social interaction compliance than the other two categories. The Over 30 Under 80 category

providing less than 30% of sites, (Nr 2) with compliance where all horses can undertake social interaction whilst housed.

Free Exercise data does not correlate with Social Interaction data; Free Exercise data demonstrating a continuing decline as horse numbers increase, thus horses kept on smaller sites are more likely to have opportunity and access to free exercise compliance than those with larger numbers of occupants.

Social Interaction and Free Exercise was also analysed against the age of stables.

Table 6.23. Social Interaction and Free Exercise Provision Compliance: Disaggregated by Age of Stables

Age of Stables	Social Interaction		Free Exercise	
	Number (Total)	%	Number (Total)	%
Pre 1900	3 (6)	50	1 (6)	17
Post 1900 pre 1980	3 (8)	38	6 (8)	75
Post 1980	1 (4)	25	1 (4)	25

Table 6.23. demonstrates that the opportunity for social interaction has decreased between pre 1900, and Post 1900 – Pre 1980 stables, and further decreased Post 1980 stables; Post 1980 stables being 50% less likely to have social interaction compliance than Pre 1900 stables, demonstrating a continued decline.

Free Exercise data does not correlate with social interaction; free exercise increases significantly from Pre 1900 and Post 1900 – Pre 1980 study sites, but decreases post 1980, but not to the pre 1900 level. Study sites Post 1980 have identical opportunity for social interaction compliance and free exercise compliance, but there is no correlation between the two earlier date categories.

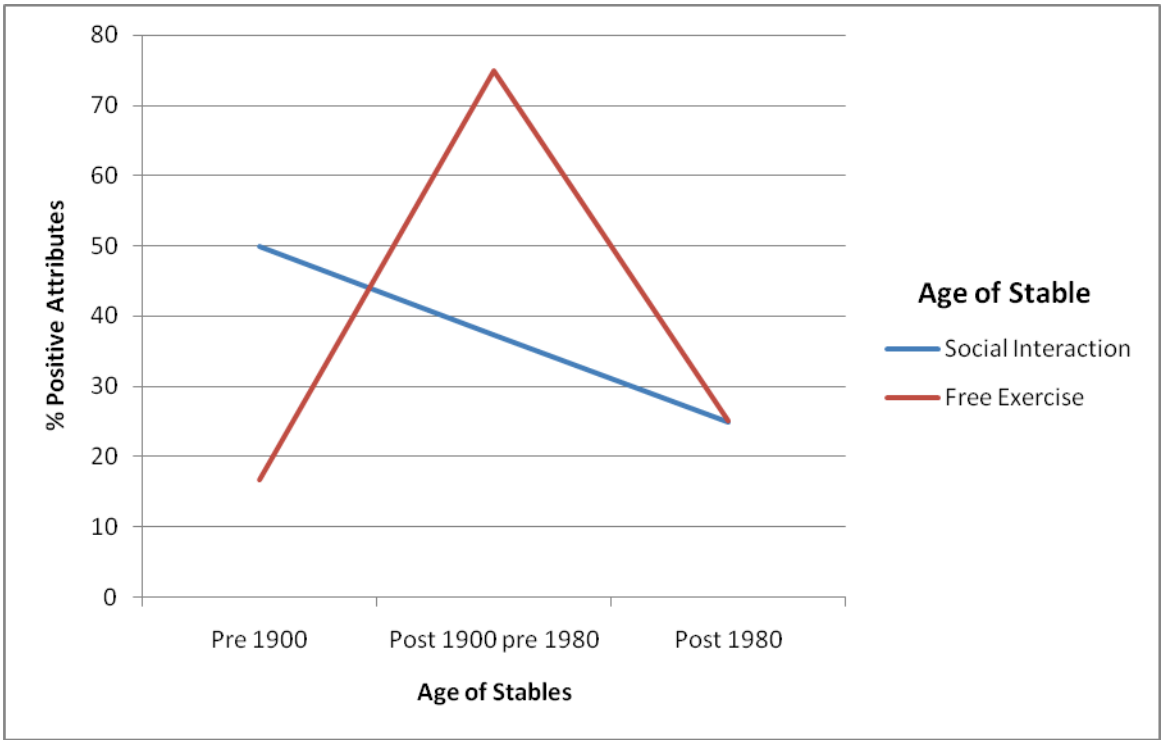


Figure 6.2. Social Interaction and Free Exercise Provision Compliance (%): Age of Stables

Figure 6.2. demonstrates that Social Interaction compliance declines taking into account the age of the stables. This demonstrates that a greater emphasis was placed on social interaction in the past, and that the opportunity for social interaction has declined since the pre 1900's.

Free exercise compliance provision does not correlate with Social Interaction compliance concerning the age of stables. Free Exercise compliance increased significantly between Pre 1900 and Post 1900 – pre 1980 sites. Post 1980 sites demonstrate a significant decline from the Post 1900 – pre 1980 sites, but does not decline as far as the Pre 1900 data, suggesting that Free Exercise compliance is not as significant as during the Post 1900 – pre 1980 time period, but still more significant than pre 1900.

Social Interaction and Free Exercise was also analysed by type of horse.

Table 6.24. Social Interaction and Free Exercise Provision Compliance (%): Type of Horse

Commercial/Non-commercial	Social Interaction		Free Exercise	
	Number (Total)	%	Number (Total)	%
Commercial	5 (11)	45	4 (11)	37
Non-commercial	7 (7)	100	4 (7)	57

Table 6.24. illustrates that social interaction opportunities are greater than free exercise opportunities, and that non-commercial sites have a greater opportunity for both social interaction and free exercise than commercial sites.

Table 6.24. also demonstrates that quantifiable levels of social interaction and free exercise are significantly low for the commercial horse; with only 45% of commercial sites providing social interaction opportunities, and only 37% of commercial sites providing a free exercise opportunity.

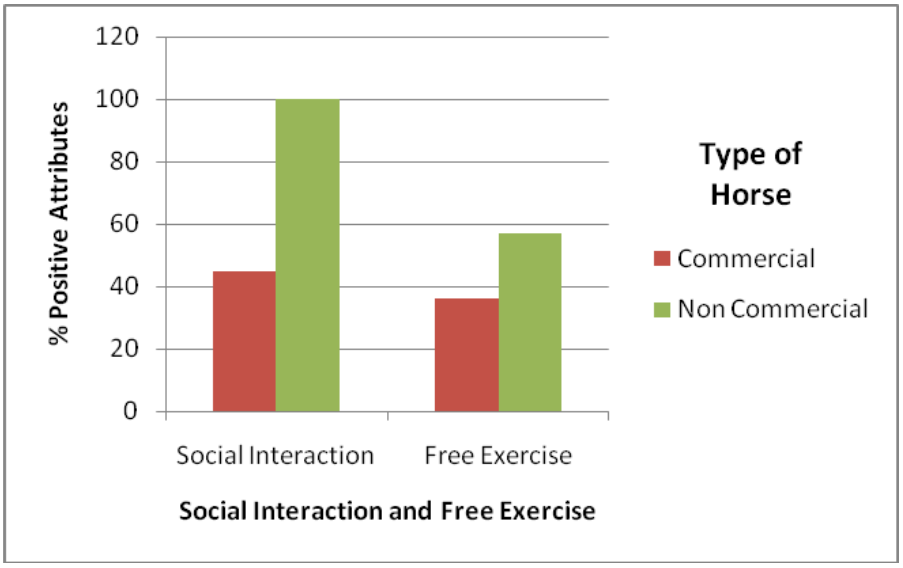


Figure 6.3. Social Interaction and Free Exercise Provision Compliance (%) Type of Horse

Figure 6.3. demonstrates that non-commercial horses have a greater opportunity for social interaction and free exercise than commercial horses.

Social interaction and free exercise both correlate regarding the type of horse; non-commercial horses having a greater opportunity for both social interaction and free exercise, commercial horses having less opportunity for social interaction and free exercise.

Table 6.25. illustrates the Floor Area (m^2) (minimum and maximum) and Wall Length (m) (minimum and maximum) for each case study site.

The mean, median and mode for the Floor Area (m^2) (minimum and maximum) and Wall Length (m) (minimum and maximum) has been calculated to enable further analysis to be undertaken. The analysis of both Floor Area (m^2) and Wall Length (m) allows for comparable analysis of the two data sets to be undertaken.

6.4. Analysis by Floor Area and Stable Wall Length

Table 6.25. Individual Case Sites Floor Area and Stable Wall Length

	Floor Area (m^2)		Wall Length (m)	
	Minimum	**Maximum**	**Minimum**	**Maximum**
[redacted]	[redacted]	16.56	[redacted]	5.00
[redacted]	[redacted]	24.00	[redacted]	6.00
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	15.75	24.00	[redacted]	6.00
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	17.50	[redacted]	5.00
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	13.50	20.25	[redacted]	4.50
[redacted]	[redacted]	21.17	[redacted]	5.80
[redacted]	17.20	22.95	4.20	5.10
[redacted]	[redacted]	17.78	[redacted]	4.87
[redacted]	[redacted]	14.00	[redacted]	4.00
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	16.00	16.00	4.00	4.00
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Mean	[redacted]	15.33	[redacted]	4.27
Median	[redacted]	14.00 & 16.00	[redacted]	4.00
Mode	[redacted]	[redacted]	[redacted]	3.00 & 3.50
[redacted]	13.37		3.65	

Key

[redacted] Non-compliant values

Table 6.25. demonstrates that across the study sites there is great variability, and also similarity regarding stable wall length and floor area.

6.5. Floor Area

The mean minimum floor area of 11.52m^2 does not meet the minimum requirements for a horse (13.37m^2), and neither for a large horse (15.60m^2).

The mean maximum floor area of 15.33m^2 does meet the minimum requirements for a horse (13.37m^2), but not for a large horse, as 15.60m^2 is required.

This brings into question the welfare implications to stable occupants and will be referred to further in the conclusion.

The median figures for minimum and maximum floor area do not correlate with the mean figures; the minimum median being less than the mean, and the maximum median being greater than the mean. This reflects the significantly larger maximum stable sizes which occur within a number of the study sites.

Table 6.25. illustrates comparables across the floor area figures; the mode being 9.00m^2 with regard to both the minimum and the maximum floor sizes at each study site. This concludes that though mean and median figures for minimum and maximum floor area are varied, the most commonly occurring stable size is the minimum recorded.

The mode; most commonly occurring stable size at 9.00m^2 for both maximum and minimum is less than the minimum required by a horse (13.37m^2) and thus also less than the minimum required by a large horse (15.60m^2), thus bringing into question welfare implications. This will be returned to in the conclusion.

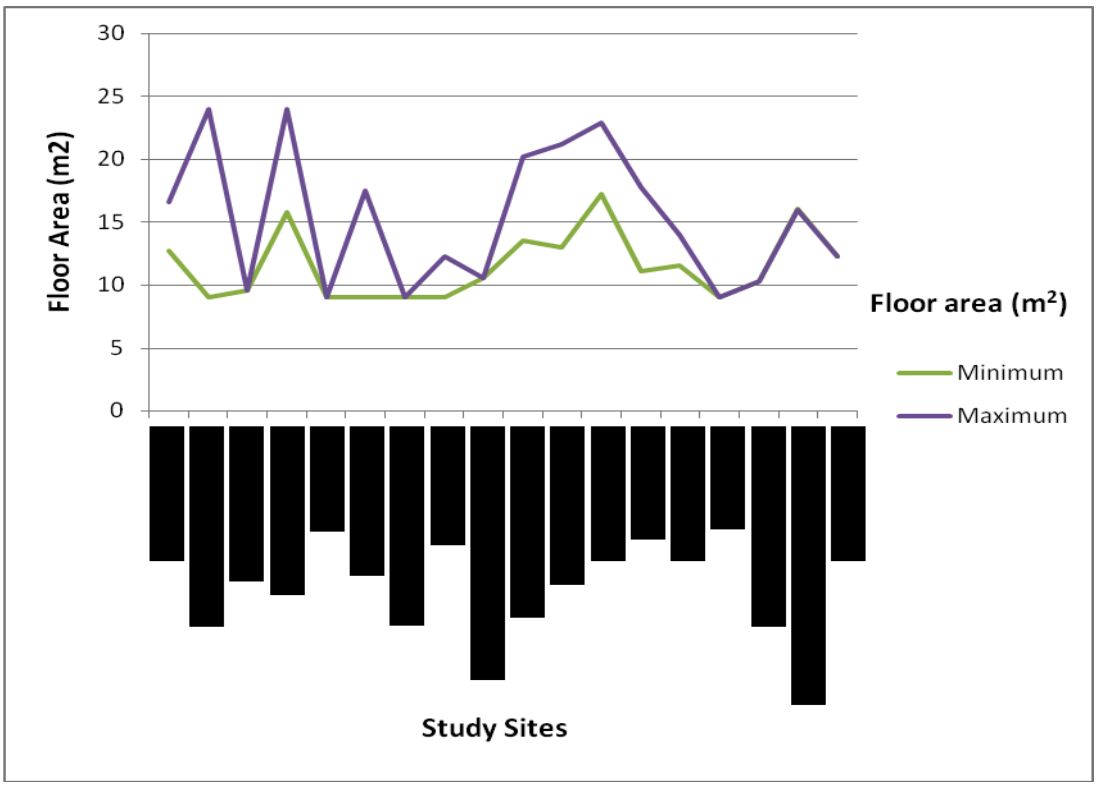


Figure 6.4. Study Sites Floor Area (m^2) Variations

Figure 6.4. demonstrates that there are significant variations in the floor area (m^2) of stables within just over half of the sites studied.

The maximum floor area (m^2) demonstrates a greater degree of fluctuation that the minimum floor area (m^2).

The data indicates that the sites with the greatest differences between minimum and maximum floor area (m^2) are sites where historic buildings are utilised; [redacted] where there is in excess of 6.00 meters difference between the minimum and maximum floor area (m^2). Each of these sites utilises historic buildings as stabling, and also modern stabling, with [redacted] utilising stables converted from stalls, [redacted] utilising an existing agricultural building with modern stable divisions, and the other sites utilising modern purpose built or sectional stabling alongside historic stabling.

The data illustrates that the four most recently established sites; [redacted] provide no differentiation in stable sizes on site.

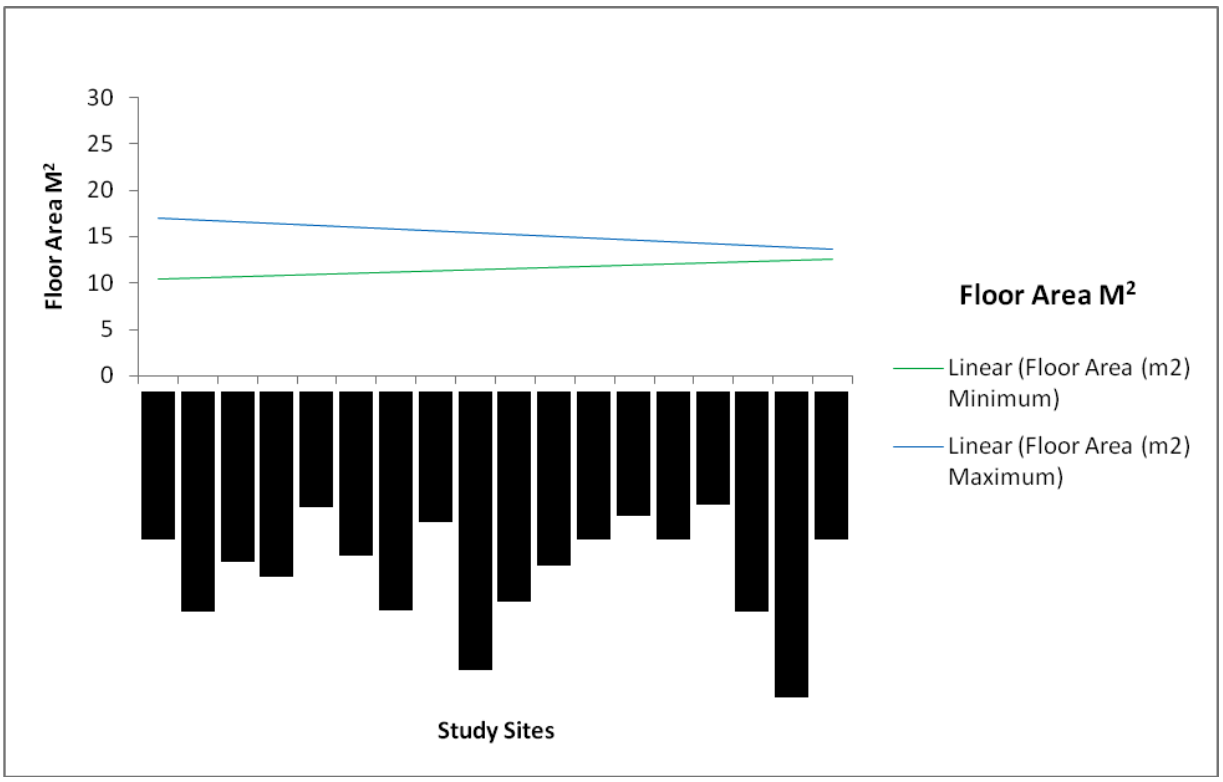


Figure 6.5. Study Sites Floor Area (m^2) Linear Trend Minimum and Maximum

Figure 6.5. demonstrates that over time the minimum floor area (m^2) has increased, but in contrast the maximum floor area (m^2) has decreased.

Data analysis in Table 6.25. and Figures 6.4. and 6.5. demonstrate a variety of stable sizes and wall lengths across the field study sites, but demonstrate a significant occurrence of stables being less than the recommended required floor size (m^2), a steady decline in the maximum floor area over time, though also a steady increase in the minimum floor area (m^2) over time, thus raising questions concerning welfare implications to the occupants, which will be referred to further in the conclusion.

6.6. Wall Length

Table 6.25. demonstrates that the minimum mean wall length of 3.20 meters is 1.07 meters shorter than the maximum mean wall length.

The median figures for minimum and maximum wall length vary by 1.00 meter, the median figures being less than the mean figures above.

Table 6.25. illustrates comparables across the wall length figures, similar to the floor area figures described above; the mode being 3.00m (minimum) and 3.00/3.50m (maximum) thus 3.00 meters being the most commonly occurring wall length across both minimum and maximum wall lengths, but not the shortest wall length.

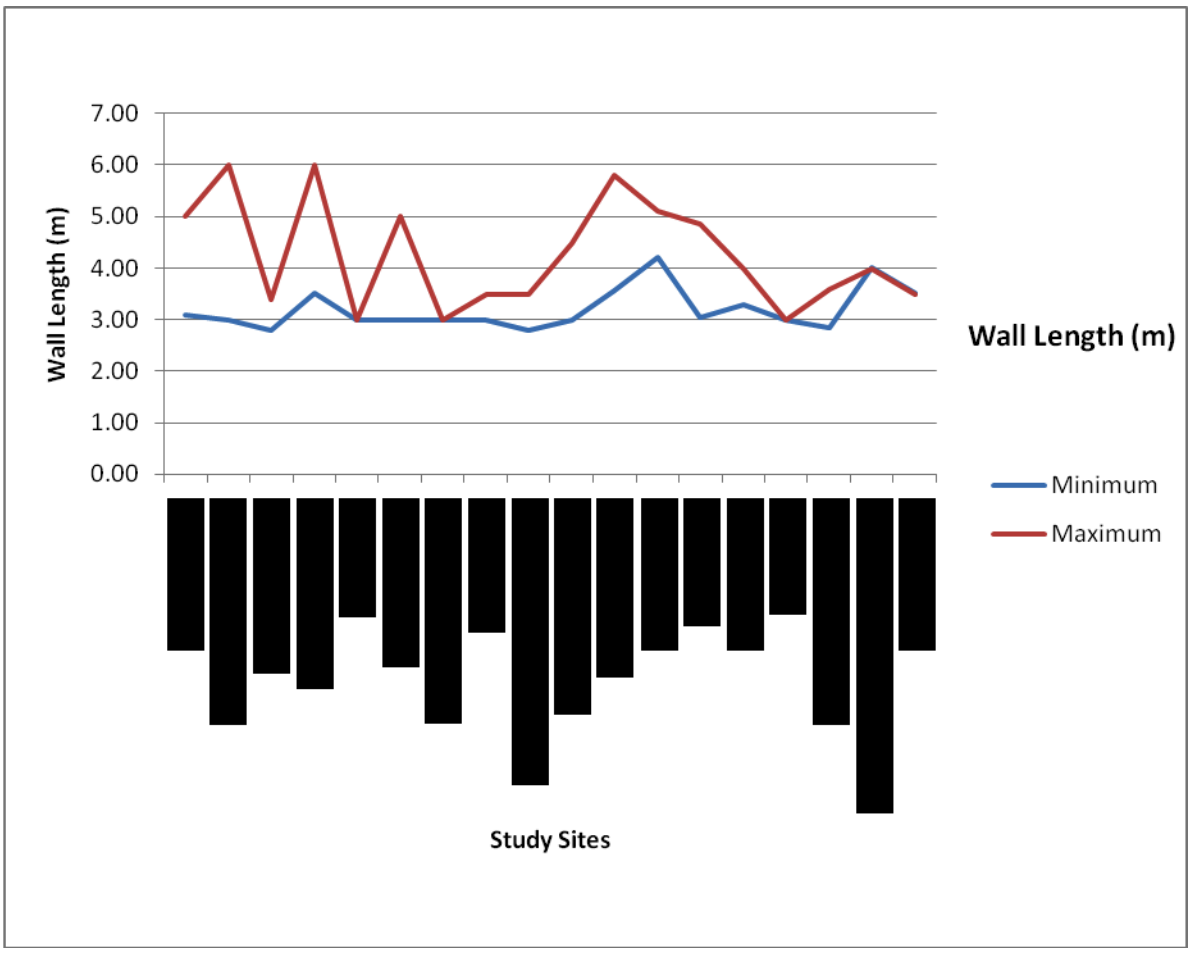


Figure 6.6. Study Sites Stable Wall Length (m)

The sites are listed in date order, taking into account the earliest stables on site.

Figure 6.6. demonstrates that at the majority of study sites, (14 Nr) there is a variety of stable sizes present.

The maximum wall length data demonstrates greater fluctuation than the minimum wall length data, but the two data sets do demonstrate a similar trend, demonstrating continuity of minimum and maximum wall lengths across stable sites.

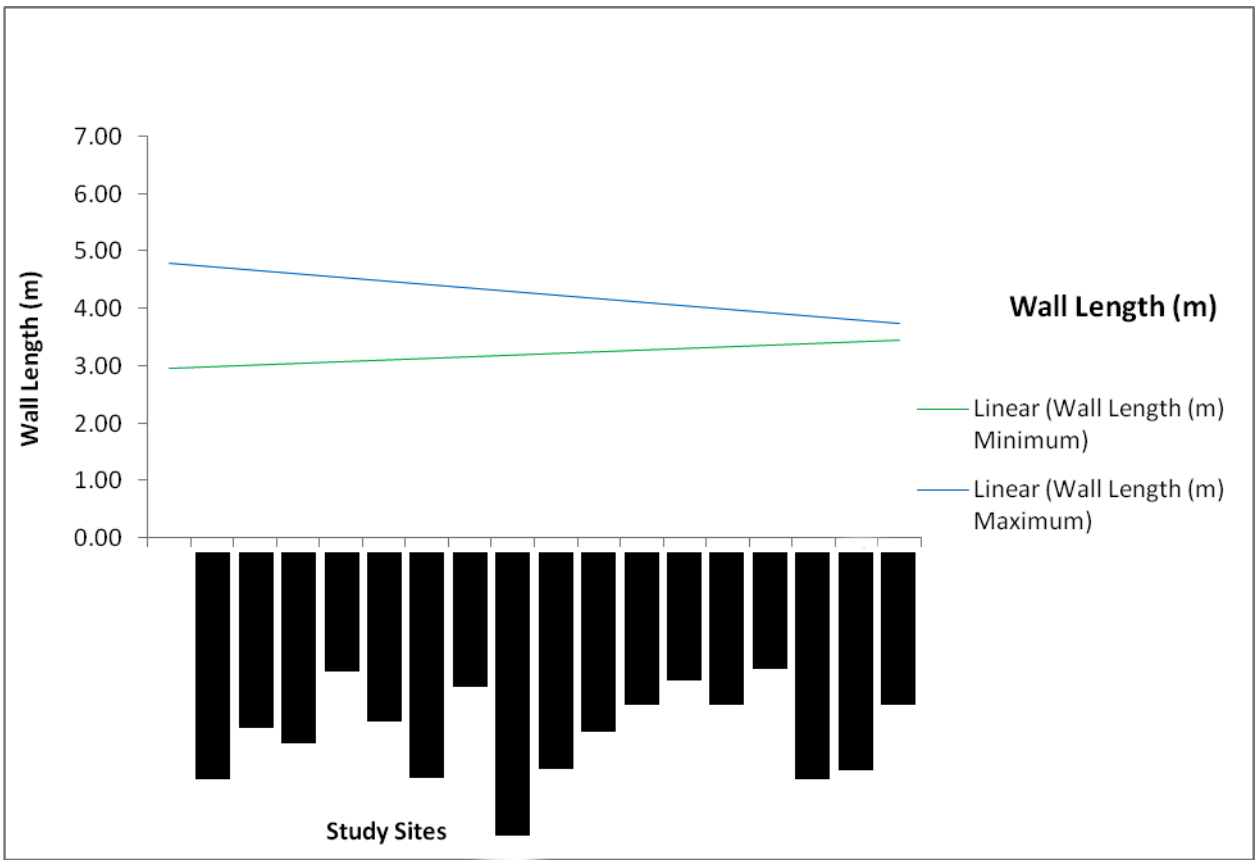


Figure 6.7. Study Sites Stable Wall Length (m) Linear Trend Minimum and Maximum

The sites are listed in date order, taking into account the earliest stables on site.

Figure 6.7. demonstrates that over time the minimum stable wall length has increased, and the maximum stable wall length has decreased.

Table 6.25. and Figures 6.6. and 6.7. demonstrate that stable wall lengths vary significantly. Mean mode and median analysis demonstrate that shorter wall lengths occur most frequently, though Figure 6.6. illustrates the variety of wall lengths present at the field study sites.

Figure 6.7. demonstrates similar trends to Figure 6.5., that minimum wall lengths are increasing and maximum wall lengths are decreasing, a similar trend to minimum floor area (m^2) increasing and maximum floor area (m^2) decreasing.

6.7. Analysis of Fitness for Purpose

Fit for Purpose

Data analysis against Fitness for Purpose criteria as defined by Raabymagle and Ladewig (2006), and Pedersen *et. al. (*2004); Raabymagle and Ladewig (2006) stating that the shortest stable wall should be at least 1.5 times the height of the horse at the withers, and that the footprint must be at least twice the height at the withers squared; Pedersen *et. al. (*2004) recommending that each stable wall should be twice the length of the horse.

As described in the literature review, specifically Table 2.2. the recommendations of Pedersen *et. al. (*2004) and Raabymagle and Ladewig (2006) are significantly different, the recommendations of Pedersen *et. al. (*2004) being significantly greater than those of Raabymagle and Ladewig (2006).

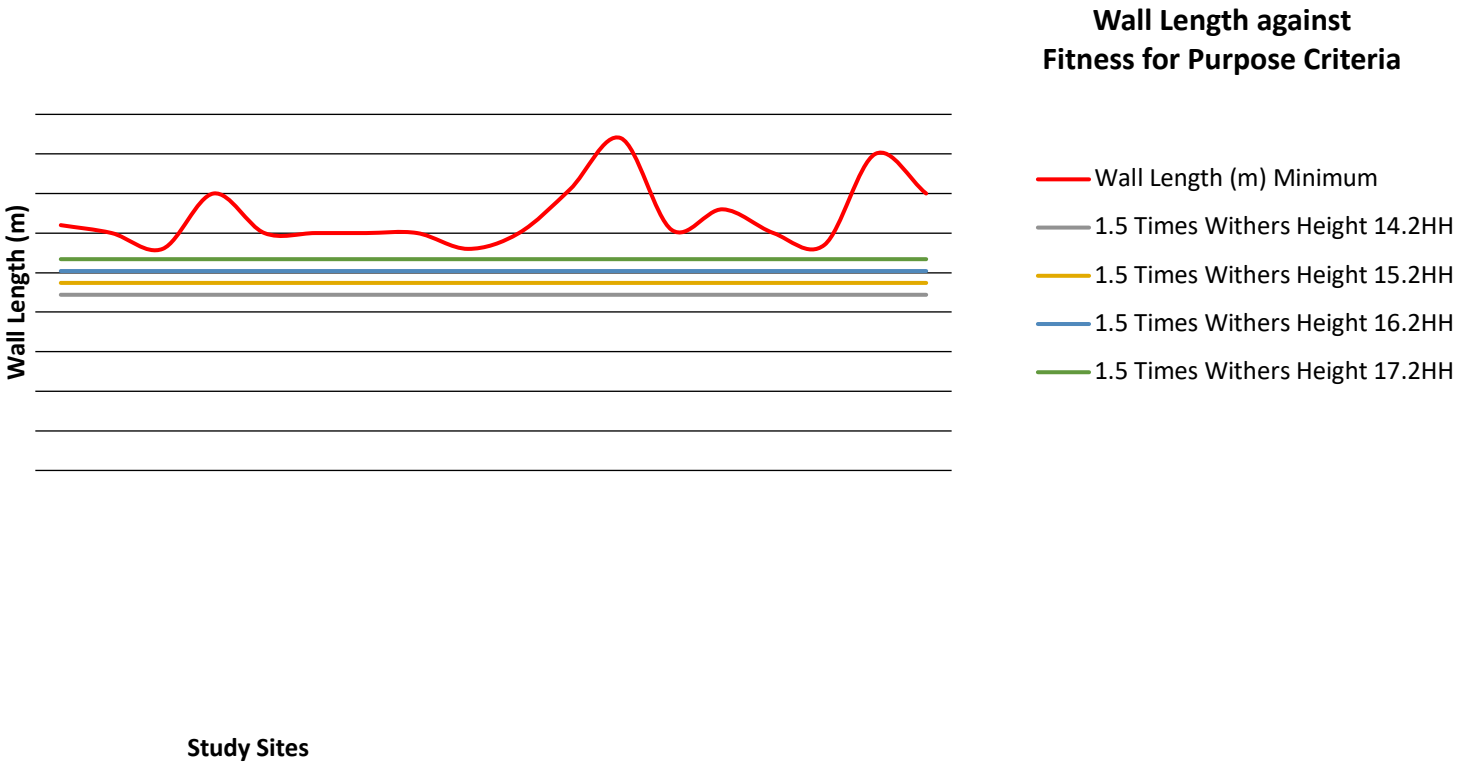


Figure 6.8. Wall Length against Fitness for Purpose Criteria

Shortest stable wall minimum 1.5 times the Withers Height of the Horse

Raabymagle and Ladewig (2006)

The sites are listed in date order, taking into account the earliest stables on each case study site.

Figure 6.8. demonstrates that when the minimum stable wall length (m) at each study site is evaluated against Fitness for Purpose criteria of a minimum of 1.5 times the withers height of the horse (Raabymagle and Ladewig, 2006) all study sites exceed the minimum.

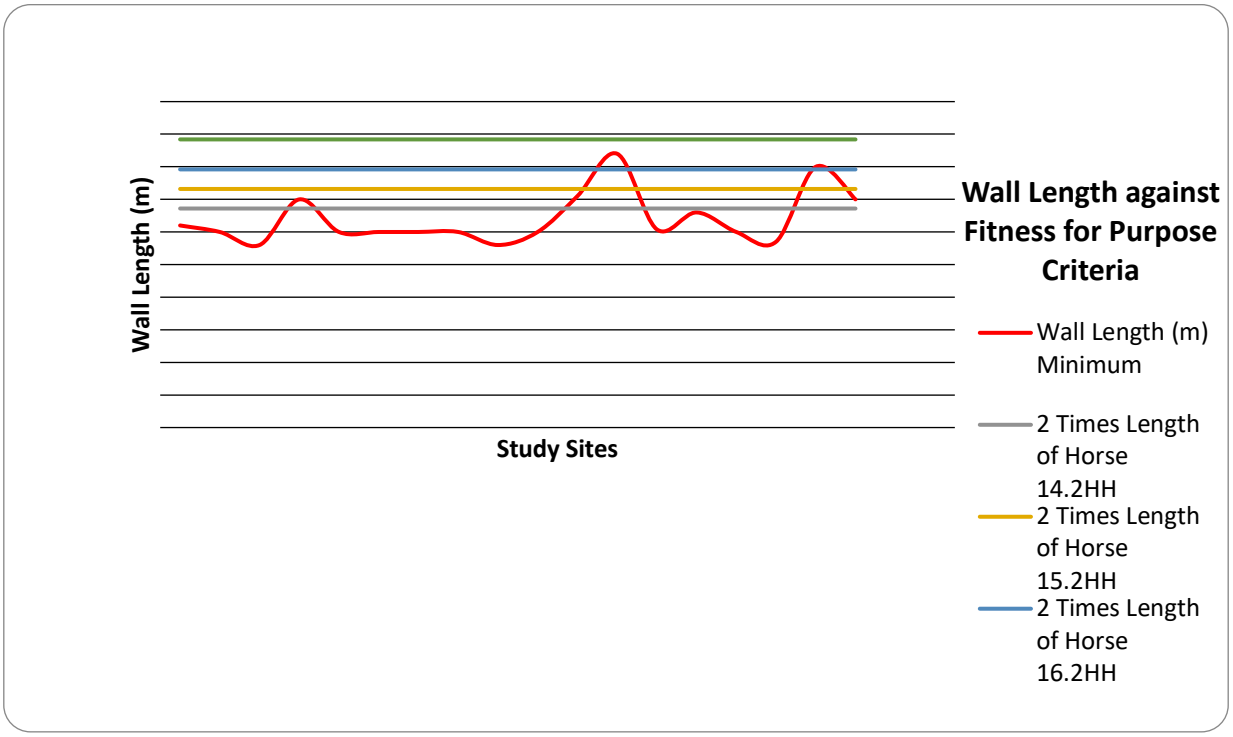


Figure 6.9. Wall Length against Fitness for Purpose Criteria

Each stable wall minimum 2 times the Length of the Horse

Pedersen *et. al. (*2004)

The sites are listed in date order, taking into account the earliest stables on each case study site.

Horse length data has been taken from standard horse rug size chart data (Ride-Away, 2013), since Pederson *et. al.* does not state horse lengths.

Figure 6.9. demonstrates varied results when the minimum stable wall length (m) at each study site is evaluated against Fitness for Purpose criteria of a minimum of 2 times the length of the horse (Pederson *et. al*, 2004).

At only 5 study sites (28%) do the stables exceeded the minimum requirements of Pederson *et. al.*, (2004). with regard to the walls being at least twice the length of the horse for a 14.2HH pony.

Only 2 study sites (11%) had all stables exceeding the Pederson *et. al.*, (2004) minimum requirements for stable walls being at least twice the length of the horse, for a 15.2HH horse.

The 2 study sites that met the Fitness for Purpose criteria (Pederson *et. al.*, 2004). for a 15.2HH horse also met the criteria for a 16.2HH horse.

There were no study sites that met the Pederson *et. al.*, (2004) criteria for the stable wall length being twice the length of the horse, for a 17.2HH horse.

This indicates that the entire sample of the study sites, a valid sample representation of the stables within the South and South East of England do not meet Fitness for Purpose criteria as stipulated by Pederson *et. al.* (2004) with regard to stable wall length.

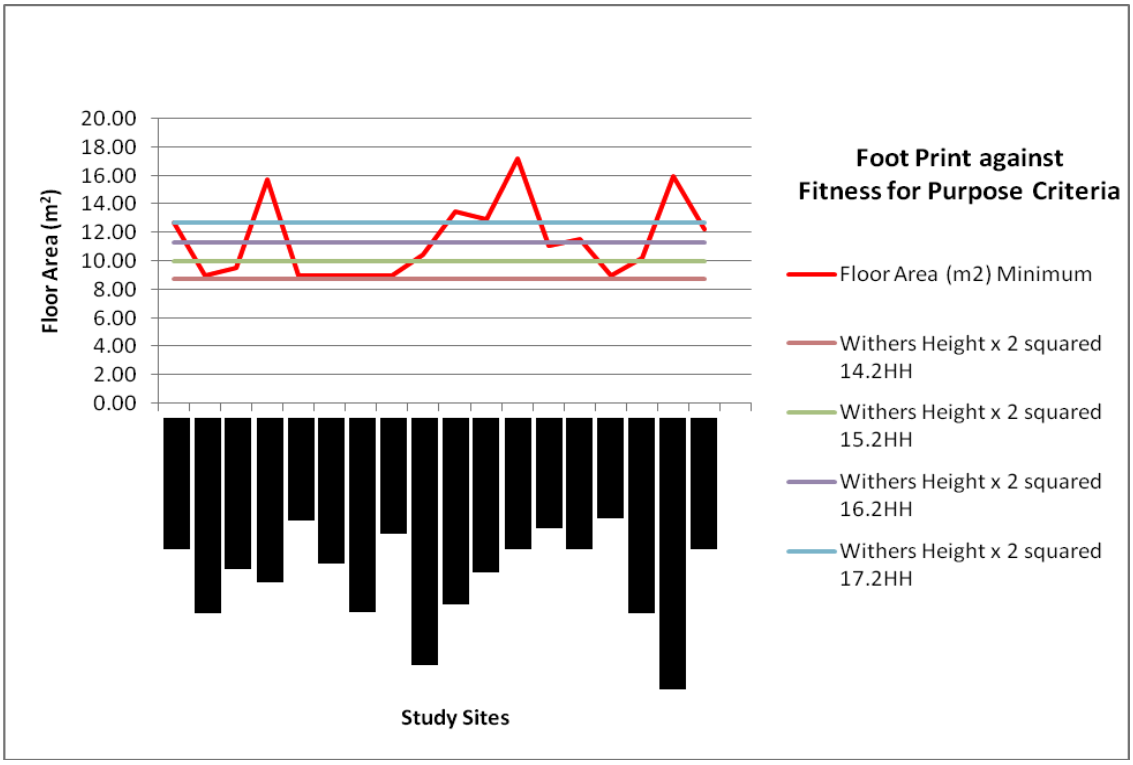


Figure 6.10. Foot print against Fitness for Purpose Criteria

Minimum Stable Floor Foot Print 2 times the Withers Height of the Horse, squared
Raabymagle and Ladewig (2006)

The sites are listed in date order, taking into account the earliest stables on site

Figure 6.10. demonstrates varied results when the minimum foot print (m^2) at each study site is evaluated against Raabymagle and Ladewig (2006) Fitness for Purpose criteria of a minimum of 2 times the withers height of the horse, squared (Raabymagle and Ladewig, 2006).

All eighteen study sites (100%) exceed the minimum foot print Fitness for Purpose criteria (withers height x 2, squared) for a 14.2HH pony.

Eleven (61%) study sites exceeded the minimum foot print Fitness for Purpose criteria for a 15.2HH horse.

This reduces to eight (44%) study sites exceeding the minimum foot print Fitness for Purpose criteria for a 16.2HH horse.

This reduces to six (33%) of study sites exceeding the minimum footprint Fitness for Purpose criteria for a 17.2HH horse.

The data analysed in Figure 6.10 concludes that though the study sites are all suitable/Fit for Purpose for a 14.2hh pony, only 61% are suitable for a 15.2hh horse, thus 2/3 of field study sites do not meet the Fit for Purpose criteria stated by Raabymagle and Ladewig (2006) regarding the stable footprint requirements for any horse. This will be returned to in the conclusion as questions of equine welfare.

6.8. Data Analysis Summary

The data analysis has determined that stables in current use are compliant in terms of construction, fixtures and fittings, floors and roofs.

The data analysis has raised a number of questions concerning stables in current use in terms of lighting, and windows and ventilation.

The data analysis has raised a number of significant questions concerning stables in current use in terms of stable size and also opportunities for Social Interaction and Free Exercise.

The data illustrates that regarding stable floor area (m^2), there is a greater degree of fluctuation in maximum floor area (m^2) than minimum floor area (m^2). The data also illustrates that the four most recently established sites provide no differentiation in floor area (m^2).

The data analysis has raised questions concerning the Fitness for Purpose for the modern Equidae of the current stabling provision within the UK, which will be returned to in the following conclusion chapter.

Chapter Seven

7. Conclusion and Recommendations

7.1. Conclusion

Following completion of the case study research, and analysis of the data, the following conclusions have been reached:

Literature concerning stable design and construction has changed little within the current, and previous century beyond the common movement away from the use of stalls, thus increasing the use of stables as standard.

The data analysis demonstrates a significant move away from the use of stalls in recent times, which is reflected in the literature reviewed.

The data demonstrates that construction, fixtures and fittings, floors and roofs are all fully compliant with DEFRA (2006) criteria and thus deemed Fit for Purpose.

Two sites demonstrate deficiency regarding stable doors, due to the use of inwards opening stable doors, and the use of gates instead of stable doors. When the data is disaggregated by Age, a correlation is demonstrated, as both sites are in the categories prior to Post 1980. The sites are both in the Fewer than 30 horse category, thus demonstrating a correlation between horse numbers and DEFRA (2006) compliance. A further trend is evident, as both non-compliant sites are non-commercial, questioning Fitness for Purpose at these two non-commercial sites.

Lighting is deficient at two sites, both utilising bare domestic light bulbs, which when the data is disaggregated by Age demonstrates no correlation trend regarding compliance, though a trend is demonstrated with data disaggregation by Number of Horses, as all sites in the Above 80 Horses category were compliant with DEFRA (2006) criteria. Data disaggregation by Type of Horse demonstrates a correlation, both non-compliant sites being commercial.

Windows and ventilation slats data demonstrates a correlation regarding Age, as only one non-compliant site is within the Post 1980 category. The data demonstrates a non-compliance correlation regarding Number of Horses, with smaller (Fewer than 30

Horses) sites being questionable regarding Fitness for Purpose. Disaggregation regarding Type of Horse demonstrates a similar level of Fitness for Purpose non-compliance across both non-commercial and commercial sites.

The data demonstrates that Post 1980 sites have the greatest percentage of compliance regarding the DEFRA (2006) criteria for Size: Horse, demonstrating a compliance correlation regarding Age, and thus Fitness for Purpose. Sites with 30 – 80 horses are more likely to be compliant regarding Size: Horse, bringing into question Fitness for Purpose at smaller (Fewer than 30) and larger (Above 80 Horses) sites. Data disaggregation by Type of horses demonstrates a greater proportion of non-compliance within commercial sites, allied to a greater use of stalls at these sites, with all but one site utilising stalls being in the commercial category, bringing into question Fitness for Purpose at these sites.

None of the sites fully meet the requirements regarding the size of stables for a large horse, thus indicating that there are limited adequate facilities for large horses, and that the stables in use have to be considered as failing the Fitness for Purpose criteria concerning this factor.

The data demonstrates a correlation trend between Age and Fitness for Purpose regarding Social Interaction, with 75% of Post 1980 sites being compliant. A further trend concerning Number of Horses is demonstrated by the data, with social interaction declining as horse numbers increase. Social interaction demonstrates a significant difference regarding Type of Horse, with all non-commercial sites being compliant against Fitness for Purpose criteria, and only 45% of commercial sites being compliant, thus bringing into question Fitness for Purpose at these commercial sites.

With regard to Age, the data demonstrates a general declining trend towards Free Exercise compliance over time, this trend being reflected regarding Free Exercise also. Free Exercise data disaggregation regarding Type of Horses demonstrates significant Fitness for Purpose failing within the commercial category, with 64% of sites being non-compliant. Two sites in the non-commercial category were not compliant, but these sites were not deemed necessarily Fitness for Purpose non-compliant due to the fact

that both sites were veterinary establishments, and thus free exercise for the inpatients may not be appropriate.

The data demonstrates that the mean floor area (m^2) for commercial horses specifically does not meet the minimum DEFRA (2006) criteria, though the mean floor area (m^2) for non-commercial horses does, thus demonstrating a significant difference between accommodation for commercial and non-commercial horses.

Taking all the field study sites (no disaggregation) into account, the minimum mean floor area (m^2) does not meet the minimum DEFRA (2006) criteria, 11.52m^2 being significantly less than the requirements for a horse, and for a large horse.

Taking all the field study sites (no disaggregation) into account, the maximum mean floor area (m^2) does meet the minimum DEFRA (2006) criteria for a horse, but not for a large horse.

The most commonly occurring (mode) minimum and maximum floor areas are identical, being the minimum recorded, thus confirming that most stables at the field study sites have the smallest floor area (m^2) and that this is below the minimum stated by DEFRA (2006) for both a horse and a large horse.

The data demonstrates that floor area (m^2) has changed over time, with the minimum increasing, but the maximum decreasing.

This brings into question the welfare implications of the majority of stables not conforming to the DEFRA (2006) requirements regarding floor area (m^2) for a horse, and for a large horse, and thus the welfare implications of many horses being accommodated in stables deemed to be inadequate regarding floor area (m^2).

Taking into account Fitness for Purpose regarding the minimum wall length (m) being a minimum of 2 times the length of the horse (Pederson *et. al.,* 2004); only Nr 5 field study sites (28%) were adequate for a 14.2HH pony; only Nr 2 field study sites (11%) were adequate for a 15.2HH horse and for a 16.2HH horse; and none were adequate for a 17.2HH horse.

This indicates that the entire sample of field study sites, a valid representation of the stables within the South and South East of England do not meet Fitness for Purpose criteria as stipulated by Pederson *et. al.,* (2004), thus bringing into question the welfare implications of utilising stables with inadequate wall lengths.

Foot print (m^2) was further evaluated against Raabymagle and Ladewig (2006) Fitness for Purpose criteria; the minimum required being withers height x 2, squared. Only Nr 11 (61%) of field study sites were found to be adequate in this respect for a 15.2HH horse; only Nr 8 (44%) for a 16.2HH horse and only Nr 6 (33%) for 17.2HH horse. This further brings into question the Fitness for Purpose of stabling in current use for the modern Equidae, and the welfare implications of the inadequate stabling in current use.

To conclude regarding the modern horse; stalls are rarely utilised for the modern horse, but floor area (m^2) does not meet DEFRA (2009) requirements in the majority of cases; Fitness for Purpose regarding minimum wall length being a minimum 2 times the length of the horse (Pederson *et. al.,* 2004) was not completely met for 14.2HH ponies, 15.2HH or 16.2HH horses and not at all for 17.2HH horses; and with regard to minimum floor footprint (m^2) being withers height x 2, squared, less than two thirds of stables studies were adequate for 15.2HH horses, less than half were adequate for 16.2hh horses, and only a third were adequate for 17.2HH horses.

These findings bring into question the Fitness for Purpose of stables currently utilised by the modern Equidae.

To conclude concerning social structure of the horse; stables utilised by the modern Equidae take no account of the social structures of the horse, therefore Fitness for Purpose is brought into question.

Group housing was not analysed within this study. From the literature reviewed group housing is uncommon within the UK, though it is more common in other European countries. Group housing is therefore referred to further in the recommendations below.

To conclude concerning social interactions and time budgets of the modern horse, though literature is available concerning social interaction, and time budgets of the modern horse, there appears to be little consideration of these factors within the design

and construction of stables and stable yards. This is a concern regarding Fitness for Purpose.

Social interaction and time budgets are therefore referred to further within the recommendations below.

With regard to social interaction and free exercise, there is no correlation between social interaction and free exercise when taking into account the number of horses or the age of the stables, but there is a significant correlation regarding the type of horse; with social interaction and free exercise opportunity being significantly less for the commercial horse than for non-commercial horses.

This brings into question the welfare implications for commercial horses concerning a lack of opportunity for both social interaction and also free exercise.

7.2. Analysis of attainment of the research aim

The aim of the study was to investigate whether stables in current use in the UK are Fit for Purpose for modern Equidae (horses, ponies, donkeys and their hybrids).

The literature review (Chapters Two and Three) have investigated the development of the modern horse, social structures of the horse, social interaction and time budgets of the horse, stabling, health of the horse, management of the horse, the evolution of stables and stable yards and the design and construction of the modern stable and stable yard and Fitness for Purpose.

Within the literature, there has been very little evidence relating to the modern stable being Fit for Purpose for the modern Equidae, regarding the “expected” defined requirements of a suitable stabling facility.

The case study field work detailed within Chapter Five, the case study data analysis within Chapter Six, and Chapter Seven detailing the Conclusions and Recommendations drawn from the work undertaken have culminated in the attainment of the research aim.

7.3. Analysis of attainment of each of the objectives

Objective 1 Analysis of welfare requirements of the modern Equidae

Objective 1 was attained by the investigation into relevant literature, culminating in the synthesis of the literary findings within Chapter Two; Literature Review: Horse, and Chapter Three; Literature Review: Stable, which includes equine welfare legislation and Fitness for Purpose.

Objective 2 Analysis of evolution of the stable

Objective 2 was attained by the investigation into relevant literature, culminating in the synthesis of the literary findings within Chapter Three; Literature Review: Stable, and undertaking the case study field work detailed within Chapter Five.

Objective 3 Synthesise the fitness for use of stables for the modern Equidae

Objective 3 was attained by the investigation into relevant literature, culminating in the synthesis of the literary findings within Chapter Two; Literature Review: Horse, and Chapter Three; Literature Review: Stable, which includes equine welfare legislation and Fitness for Purpose.

Objective 3 was further attained by the undertaking of the case study field work detailed within Chapter Five, and the case study data analysis within Chapter Six, culminating in the production of the Conclusions and Recommendations within Chapter Seven.

Objective 4 Evaluate the fitness for purpose of stables and provide a framework for future use

Objective 4 was attained by the investigation into relevant literature, culminating in the synthesis of the literary findings within Chapter Two; Literature Review: Horse, and Chapter Three; Literature Review: Stable, which includes equine welfare legislation and Fitness for Purpose.

Objective 4 was further attained by the undertaking of the case study field work detailed within Chapter Five, and the case study data analysis within Chapter Six, culminating in the production of the Conclusions and Recommendations within Chapter Seven.

Objective 4 was further attained by the production of a framework for future use regarding stable accommodation Fitness for Purpose criteria for the modern Equidae. The framework is detailed in Table 7.1. Revised Fitness for Purpose Framework.

7.4. Original contribution to knowledge

This is a unique study, in many aspects; the evolution of the stable, horse management best practice, and specifically and most importantly, are the stables in current use actually meeting the requirements of the horses stabled within, being actually Fit for Purpose, or not? To the authors best knowledge there has been no similar academic study undertaken.

The investigation into the evolution of stable and stable yard design will be unique in that it also investigated how the changes within stable design practices reflect the socio-economic use of the horse, thus allowing for comparisons to be made between the actual design and build and the use of the horse, both at the time of the build, and also the current use if that is different or applicable to the individual study sites.

The literature review in itself is an original contribution to knowledge, being a unique detailed review of literature concerning historic and modern texts, books, journal articles, research data and on-line sources. This is the first incidence that all these resources have been collated within a single study.

The practical case study field work is a unique contribution to knowledge as it provides practical study data concerning a variety of stable accommodation sites, across a variety of ages, numbers of horses accommodated and types of horses accommodated, in a variety of settings; rural, urban, historic, modern, commercial, non-commercial, specifically built for purpose and utilising buildings converted from a previous alternative use.

The case study data produced (Chapter Five) and the case study data analysis (Chapter Six) are both unique sources of information concerning stable accommodation utilised by the modern Equidae, and the level to which this accommodation is Fit for Purpose for the Modern Equidae housed within it.

It was expected to find that stables were only partially Fit for Purpose, and from the case study data analysis (Chapter Six) and the Conclusions and Recommendations synthesised within Chapter Seven, this expectation has proven to be correct.

7.5. Analysis of the effect of exclusions, constraints, limitations and reservations for the reliability and generalisation of the results

Due to the Constraints, Reservations and Limitations to the study predominantly of case study site visits within the fieldwork a limited number of sites (Nr 18) were assessed. The case study sites were purposefully selected to provide the widest possible sample of stabling, and also to incorporate a typical example of stabling. Stabling for Equidae only was included, with stabling for all other domestic livestock excluded.

Reservations within the study include access to sites to undertake the fieldwork and the refusal to permit access to certain sites which may have been of importance to the study. This reservation was addressed within the triangulation of data and the limits placed upon the generalisations of the research conclusions and recommendations.

Further reservations included the level of research knowledge of those granting permission so that the fieldwork could be undertaken as required by the research protocol, and that evidence is not omitted due to distractions or interference from those granting permission, or accompanying the research visit. This issue was addressed with the Ethical Approval process of the research protocol.

The restricted geographical coverage of the study sites are perceived as a potential limitation, though the geographical range was specifically identified to provide the range of stable sites necessary to produce data that was generalised to the wider UK. The study was restricted specifically to the UK for practical study reasons, and further geographically to the East, South East and London for practical study reasons.

The restriction not to include human-horse interaction, and resultant behaviour patterns are perceived as potential limitations, though are beyond the remit and extent of this specific thesis, and would be better placed in a behavioural study specifically.

Constraints regarding the study are minimal, with time being the largest constraint; especially where accompanied access to a site was limited to a certain timescale, which

could not be extended, and thus data collection had to occur within the limited timescale, regardless of if more time would be preferable in certain instances.

Reservations for the reliability of the results is minimal due to the rigorous research protocol undertaken, both in practical case study site selection, case study site data collection, and also the methodology utilised to analyse the data.

Reservations for the generalisation of the results is minimal due to the rigorous research protocol undertaken, both in practical case study site selection, case study site data collection, and also the methodology utilised to analyse the data.

7.6. Recommendations

It is recommended that the DEFRA (2009) code be revised and amended to include specifications for minimum stable sizes, social interaction and free exercise taking into account the literature reviewed, the results and the conclusions of this research study, thus ensuring Fitness for Purpose for the modern Equidae.

It is recommended that the relevant Codes for Scotland, Wales and Northern Ireland are revised and amended in a similar manner.

It is recommended that the following framework (Table 7.1.) is adhered to regarding revised Fitness for Purpose criteria of stable accommodation for the modern Equidae:

Table 7.1. Revised Fitness for Purpose Framework

Item	Specification
Construction	The building should be constructed soundly, with no exposed surfaces or projections likely to cause injury. The construction should provide adequate thermal comfort for the stabled horse. This may require insulation in exposed locations. All surfaces should be capable of being cleaned and disinfected. If surfaces are treated, non-toxic paints or wood preservatives should be used.

Fixtures and Fittings	Fixture and Fittings such as tie rings, hay racks and water bowls should reflect safety in use; be free of sharp edges and positioned so as to avoid injury, particularly to the eyes. Fixtures and fittings should reflect the natural feeding position; if used, hay nets should be fixed at the horse's head height, allowing the horse to eat comfortably yet avoiding the risk of the horse getting its feet or head collar caught in the net when empty.
Floors	Floors should be reasonably even, nonslip and designed to give good drainage, taking stable waste away from the horse with falls and cross falls of 15mm per meter. Concrete should be specified to provide a non-slip finish and be resistant to deterioration from horse waste. Rubber mats should be green, red, brown or grey.
Doors	Doors should be a minimum of 1.25m (4 ft) wide. The height of the door should allow the horse or pony to look out with the head comfortably over the door. The door should open outwards or be sliding doors. The bottom door should be capable of being securely fastened with top and bottom bolts. Stables may also have a top door which should be capable of being secured in the open position. You should be aware that shutting the top door reduces ventilation and natural light.
Roofs	Roofs should be high enough to provide adequate ventilation including good air circulation. There should be a minimum clear space to the eaves of 60-90 cm (2-3 ft) above the ears of the horse in its normal standing position.

Light	Sufficient light is essential within all stabling both for the horse to see adequately, and also to enable inspection and safe handling of horses at all times. Daylight is preferred but can be supplemented by artificial lights. Artificial light can include portable lighting. Light bulbs should be enclosed in safety fittings with cabling secured well out of reach. When natural light is limited, the interior of the stable should be painted with non-toxic light coloured paint.
Windows and Ventilation Slats	Windows and ventilation slats should provide adequate natural air circulation without creating draughts. Perspex or safety glass (with grilles fitted between the horse and the glass) is prescribed. One window or top door should normally be open at all times. Windows should be sited so that they are not obscured by an open top door. Adequate ventilation in any equine housing is essential. When natural ventilation is below four air changer/hr then specialised mechanical ventilation can be utilised to achieve the required air changes. Levels of dust within stables should be kept to a minimum and there should be a good flow of air through the buildings without unnecessary draughts.

Size	Horses and ponies vary greatly in size so that it is difficult to set an ideal size for stables. However, as a minimum, each horse should have sufficient room to lie down, readily rise and turn around in comfort. Stables for special circumstances (foaling, veterinary care etc) will require additional space. All passageways should be sufficiently wide to enable horses to be led safely past other horses. The following are a minimum standard: The minimum wall length is 2 times the length of the horse, or 1.5 times the withers height of the horse, whichever is the greatest. The minimum stable floor footprint is 2 times the withers height of the horse, squared
Social Interaction	As a minimum the horse must be able to exhibit social behaviours with another horse whilst in stable accommodation. Stable and stall location and design must be adequate to ensure adequate social interaction. Design considerations such as the use of windows, partitions and internals grills may enhance the social interaction adequacy.
Free Exercise	A minimum of 1 hour per day of free exercise to be provided, with a minimum of 3 – 4 hours being recommended.
Fire Precaution	Stable premises must adhere to the Communities and Local Government's Guide to Fire Safety in Animal Establishments and Stables. Further specific advice should be sought from a local Fire Prevention Officer

Stall Use	It is prescribed that stalls are only utilised by commercial horses, and only where it is impossible to accommodate the horses in stables on the site. When the use of stalls is unavoidable, it should only be for short periods; for the training and customisation of the horse to the stall; to alleviate exceptional horse numbers during particular events; and horses must be adequately rotated between stalls and stables.

Adapted from DEFRA (2006)

It is recommended that DEFRA (2006) Code non-compliance is not considered a Fitness for Purpose failure, but rather that each specific context must be considered in providing a holistic judgement of Fitness for Purpose rather than individual criteria being evaluated individually. An example of this being stable management rather than design conferring Fitness for Purpose at [redacted], as described in 6.1.8.

It is recommended that the work of Hall and Cassaday (2006) be considered further with regard to the colour of rubber floor mats, and the utilisation of more naturally occurring colours, rather than black.

It is recommended that specialist advice is sought for each stable project regarding the specification required to achieve the selection of appropriate concrete which is non-slip and also will not react or deteriorate due to horse waste products.

It is recommended that the specification for concrete floors should include a fall and cross fall of 15mm per meter towards the doorway.

It is recommended that an Addendum to the DEFRA (2006) Code should be added providing an assessment of Fitness for Purpose criteria for stalls.

It is recommended that awareness is raised concerning this research into stable Fitness for Purpose, and stable Fitness for Purpose requirements for the modern Equidae within the equine academic, professional and layman fields, with the intention that a greater awareness of the Fitness for Purpose requirements will aid the improvement of existing stable facilities, and influence the design of stable building projects in the future.

7.7. Recommendations for Further Study

It is recommended that further study is required to determine the welfare implications of stabling being too small for occupants, both in terms of floor area (m^2) and also wall length.

It is also recommended that further study is required to determine the welfare implications of the limited opportunity for social interaction and free exercise, specifically for commercial horses.

It is recommended that group housing be investigated further, as group housing was not included as part of this study, and therefore was not analysed.

It is recommended that group housing be investigated to determine its Fitness for Purpose for the modern Equidae.

It is recommended that social interaction and time budgets of the modern horse are investigated further regarding stables and stabling Fitness for Purpose.

It is recommended that further study be undertaken concerning both social interaction, as described above, and free exercise, to determine the Fitness for Purpose of facilities which do, and do not provide free exercise opportunities, and also the effectiveness of the free exercise opportunity provided.

Foaling box/stable sizes are not detailed within literature in a comprehensive manner for a variety of horse sizes or types, and therefore it is recommended that research is undertaken to determine the specifications for foaling boxes, and that these specifications are published.

It is recommended that further study be undertaken regarding existing leisure horse owners, to evaluate their understanding and appreciation of the Fitness for Purpose requirements of the horse.

It is recommended that further study be undertaken regarding existing commercial owners, to evaluate their understanding and appreciation of the Fitness for Purpose requirements of the horse.

It is recommended for further study be undertaken concerning leisure horse and commercial horse owners, to determine what practices can be put in place to address inadequacies concerning Fit for Purpose, and thus improving the current stabling situation.

It is recommended that further study be undertaken regarding stable designers, for all stable accommodation (commercial and non-commercial), to evaluate their understanding and appreciation of the Fitness for Purpose requirements of the horse.

It is recommended that further study be undertaken regarding stable builders, for all stable accommodation (commercial and non-commercial), to evaluate their understanding and appreciation of the Fitness for Purpose requirements of the horse.

It is recommended that further study is required concerning fire precautions, both regarding compliance with the Communities and Local Government's Guide to Fire Safety in Animal Establishments and Stables, practical firefighting provision and the provision of adequate practical emergency plans in the case of a fire, or other emergency.

Appendices

Appendix 1 Conversion Table of Common Stable Sizes

	10.00 X 10.00 feet	12.00 X 12.00 feet	14.00 X 14.00 feet	16.00 X 16.00 feet
	100			
3.048 X 3.048 m	10.60704			
		144		
3.657 X 3.657 m		9.290304		
			196	
4.267 X 4.267 m			13.373649	
				256
4.876 X 4.876 m				19.060689

Key

	Square Feet
	Square Meters

Appendix 2 Costing for a stable yard built in 1865

		Unit/£
Carriage stables	8 stalls	280
Nag stables	6 stalls	210
Hunter stables	6 stalls	240
Strangers stables	4 stalls	160
Loose box	4	200
Carriage house	6 bays	240
Harness room	8 horses	80
Saddle room	12 horses	120
Harness cleaning room		30
Grooming shed		80
Horse bath and porch		80
Open carriage shed	2 bays	60
Stable yard		300
Dung yard		50
Boiler house		50
Smithy and shoeing shed		50
Clock turret and clock		250
6 bay hay loft		360
10 servant rooms		400
Mess room, staircases and WC's		220
TOTAL		3,460

Powell (1991)

Appendix 3 Section 1. Code of Practice for the Welfare of Horses, Ponies, Donkeys and their Hybrids. (DEFRA, 2006)

Stable Accommodation/Housing

1.11 Welfare aspects should be considered when constructing or altering buildings to provide housing for horses. The main considerations are the safety and comfort of the horses, ease of access and adequate drainage and ventilation. If poorly designed or managed, stabling can contribute to the rapid spread of disease, cause injury and pose significant fire risks.

1.12 The following comments apply equally to all forms of housing including individual stables, stalls and communal barns.

• Construction: the building should be constructed soundly, with no exposed surfaces or projections likely to cause injury. All surfaces should be capable of being cleaned and disinfected. If surfaces are treated, non-toxic paints or wood preservatives should be used.

• Fixtures and fittings such as tie rings, hay racks and water bowls should be free of sharp edges and positioned so as to avoid injury, particularly to the eyes. If used, hay nets should be fixed at the horse's head height, allowing the horse to eat comfortably yet avoiding the risk of the horse getting its feet or head collar caught in the net when empty.

Floors should be reasonably even, nonslip and designed to give good drainage, taking stable waste away from the horse.

• Doors should be a minimum of 1.25m (4 ft) wide. The height of the door should allow the horse or pony to look out with the head comfortably over the door. The bottom door should be capable of being securely fastened with top and bottom bolts. Stables may also have a top door which should be capable of being secured in the open position. You should be aware that shutting the top door reduces ventilation and natural light.

• Roofs should be high enough to provide adequate ventilation including good air circulation. There should be a minimum clear space to the eaves of 60-90 cm (2-3 ft) above the ears of the horse in its normal standing position.

• Light: sufficient light is essential within all stabling both for the horse to see adequately, and also to enable inspection and safe handling of horses at all times. This can include portable lighting. Light bulbs should be enclosed in safety fittings with cabling secured well out of reach.
• Windows and ventilation slats should provide adequate air circulation without creating draughts. Perspex or safety glass (with grilles fitted between the horse and the glass) is advisable. One window or top door should normally be open at all times.
1.13 Adequate ventilation in any equine housing is essential. Horses can develop respiratory problems if kept in housing with poor ventilation. Levels of dust within stables should be kept to a minimum and there should be a good flow of air through the buildings without unnecessary draughts.

1.14 As horses and ponies vary so greatly in size it is difficult to set an ideal size for stables. However, as a minimum, each horse should have sufficient room to lie down, readily rise and turn around in comfort. Stables for foaling and for mares with a foal at foot will require additional space. All passageways should be sufficiently wide to enable horses to be led safely past other horses.
The BHS minimum stable size recommendations are as follows:

• Horses: 3.65m x 3.65m (12ft x 12ft)
• Large horses: 3.65m x 4.25m (12ft x 14ft)
• Ponies: 3.05m x 3.05m (10ft x 10ft)
• Large ponies: 3.05m x 3.65m (10ft x 12ft)
• Foaling box (horse): 4.25m x 4.25m (14ft x 14ft)

The Donkey Sanctuary minimum stable sizes for donkeys are as follows:
• Mules: 3.65m x 3.65m (12ft x 12ft)
• Donkeys: 3.05m x 3.05m (10ft x 10ft)
• Large donkeys: 3.05m x 3.65m (10ft x 12ft)

1.15 Groups of horses can be kept together in communal barns, but care should be taken to ensure that all horses get adequate access to hay, feed and water. Sufficient space should be provided to allow free movement, and to allow all the horses to lie

down at the same time. Care should be taken to select groups that are compatible and aggressive horses should be segregated. Late term mares and mares with foals at foot have special requirements and it may not be appropriate to house these animals in communal barns.

1.16 Adequate and suitable bedding material is necessary in all equine accommodation to provide warmth, protection against injury and to enable the horse to lie down in comfort. Bedding material should be non-toxic, free of mould and excessive dust, and allow effective drainage, or be absorbent enough to maintain a dry bed and assist in keeping the air fresh. Where rubber matting is used, a small amount of disposable bedding should be added to absorb urine. Whatever bedding is used (e.g. straw, shavings, rubber stable mats etc.) it should be well managed and changed or cleaned regularly.

1.17 Fire is always a risk in stable areas. The premises should be designed to incorporate the fire safety recommendations set out in the Communities and Local Government's "Guide to Fire Safety in Animal Establishments and Stables". Advice should be sought from the local Fire Prevention Officer in relation to statutory requirements. Highly flammable liquid material or combustible material should not be stored in or close to stables where horses are housed. Smoking in stable areas should be prohibited.

1.18 All equipment and services (lighting units, fire extinguishers and alarm systems) should be kept clean, inspected annually by an appropriately qualified person and kept in good working order. All electrical installations at mains voltage must be installed, maintained and periodically inspected and tested by a competent electrician in accordance with the latest edition of the Institute of Electrical Engineers (IEE) wiring regulations. Wiring and fittings must be inaccessible to horses, well insulated, safeguarded from rodents and properly earthed. If using extension leads or cables care should be taken to reduce the risk injury to the horse. All metal pipe work and structural steelwork must be properly earthed. The risk of fire and electrocution can be reduced by having the whole installation protected by a residual current device (RCD).

1.19 Stabled horses should be capable of being released quickly in the event of fire or other emergencies in accordance with a pre-planned emergency turnout procedure.

(DEFRA, 2006).

Appendix 4 Pilot Study Template

Yard Name

Location

No of buildings

Yard Design Sketch

Building Date

History

Construction

Building Design Sketch External

Building Design Sketch Internal

Measurements

Stable Size

Eaves Height

Door Dimensions

Window Dimensions

Rain Water Goods

Fixtures and Fitting

Notes

Appendix 5 Respiratory Health

Respiratory health is described by Hessel *et. al.,* (2009) as being related to bedding materials, the roughage part of the diet and also the concentrate feed part of the diet due to the airborne particle concentration produced within the stable air, particularly within the horses direct breathing zone. Very limited research is available concerning the dust levels produced from concentrate feeds, with Hessel *et. al.* (2009) researching dust particle levels in different types of concentrate feeds and also different processing techniques utilised. It was concluded that pellets produced a greater level of dust particles than mixes, agitating a feed bucket prior to feeding resulted in a thirty to forty fold increase within the horses breathing zone compared to a few feet away from the bucket, but dampening the feed reduced dust levels, as did utilising steamed feed.

Garlipp *et. al.,* (2010) researched airborne particle levels within bedding and roughage, rather than in concentrate feed as above. They stated that the dust in the stable environment contains bacteria, bacterial toxins, fungal toxins, fungal spores, urine, dung, pollen, animal feed and animal components, the predominant sources being bedding and feed.

Experimentation concerning detected levels of dust produced from different bedding materials was undertaken by Fleming *et. al.,* (2008). A variety of bedding materials were tested within laboratory and practical management conditions. It was concluded that straw pellets generated the lowest levels of airborne particles, thus deeming it the most suitable bedding for promoting a good quality stable environment, especially for horses demonstrating allergies and chronic respiratory diseases. Where straw pellets are not available it is suggested that wood shavings, being a commercially prepared bedding material are the next best option

Garlipp *et. al.,* (2011) investigated the effect of deep litter bedding systems by combining bedding materials and manure to assess the levels of gases generated. It was concluded that it is necessary to remove manure from the bedding material to ensure good hygiene and good air quality by minimising ammonia levels.

O'Brien (2007) described Recurrent Airway Disease (RAD) – previously described as Chronic Obstructive Pulmonary Disease (COPD) or "heaves" as a disease of the stabled horse. RAD is described as an allergic response to small particles in stable air, be it fungal spores from mouldy hay and bedding, fragments of forage mites and their faeces, fragments of plant materials and dust from the animals coat. Poor ventilation increases the concentration of particles in the stable air, which compounds the problem. Conventional straw beds (which are generally deep littered around the edges), combined with poor ventilation increases the levels of breathable dust in the air.

O'Brien (2007) states that RAD can be managed with good air hygiene, with the cleanest air being in the middle of a field. A dust free management regime, involving the horse being out as much as possible, away from muckheaps and barns containing stored bedding being preferable. O'Brien states that wood shavings readily support fungal multiplication if undisturbed and containing faecal matter. In preference, dust extracted wood shavings or shredded paper or card should be utilised and cleaned regularly, thus not following a deep litter regime. Alternative organic beddings such as chopped hemp, flax or dust extracted straw are unsuitable as they decompose quickly.

Tremblay *et. al.* (1993) studied the effect of stabling on bronchoalveolar cells on horses with COPD and without COPD (control group). Bronchoalveolar lavages (BAL) were performed pre and post three weeks of stabling in stalls in a barn. The horses were fed dry timothy hay, sweet feed (concentrate) twice a day and bedded on straw. Both normal and COPD sufferers exhibited increased levels of neutrophils post stabling. COPD sufferers also exhibited increased levels of macrophages, indicating immunomodulation in COPD horses. Thus it was concluded that COPD increases with stabling due to the use of hay and straw.

Airborne dust and aeroallergen concentration was studied by Woods *et. al.* (1993) in both a conventional stabling system (C) where hay was fed and straw bedding was used and a recommended stabling system (R) where the study group was fed a complete pellet diet and bedded on wood shavings. All soiled and damp bedding was removed regularly, water and feed were provided ad libitum. It was concluded that moving the yard management from the conventional (C) system to the recommended (R) system

reduced the levels of airborne dust and aeroallergens by half, and would thus be advantageous to the health and performance of the horse.

RAO is described by Van den Hoven *et. al.* (2003) as being common in stabled horses due to dust, fungal spores, bacteria and endotoxins which causes: the nostrils to dilate; production of nasal discharge; excessive chest movement; and possibly a heave line; and reduced athletic ability; as the performance of the respiratory tract is impaired. It is stated (Tremblay *et. al.*, 1993) that dust increases: spasm in the airway; mucus production; and also neutrophils (inflammatory cell) production.

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