Session H/11.8 - Effect of management and housing on horse welfare
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# Three-dimensional design of a horse stud like better toll for technical choices of housing and welfare

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## Abstract

It is well known that captivity and the following upsetting of the horse natural habits and physiological activities have made the horse defenceless towards the numerous dangers and have exposed it to a wide range of risks. As a consequence, the safety of the infrastructures where the athlete spends the majority of its life time represent a fundamental aspect strictly linked to the prevention modalities of many pathologies found within equestrian veterinary practice. In recent year the three-dimensional designs are more and more utilised to have a complete vision of the structures. In the case of horse studs, the three-dimensional design represents the best solution to verify, in virtual imagines, the technical choices not only for housing bur also for improving welfare conditions. In fact it is possible to hypothesize and to virtually test the operative conditions needed both in terms of structures and welfare. The results of this kind of representation is optimal to research the best welfare conditions. This study refers to a virtual three-dimensional design of an equestrian centre destined to show jumping horses. This facility includes the realization of different structures such as stud and wasting areas, covered grounds, open air fields, open fields, rings, club services, competition arenas with tribunes, jury, services for public, etc..

*Keywords: horses, plans, virtual reality, studs*

## Introduction

Any design of structures destined to horses must keep in mind the horse's basic nature. Fences or stalls adequate for cattle could be hazardous or unsatisfactory for horses. The primary consideration for any horse facility is safety(Warren Evans & Borton, 1990) . The horse welfare is the basic aspect in developing a horse farm. Facilities must be designed to protect the horse. Many injuries result from human negligence, poor planning and the facilities in which the horses are kept. Many injuries can be prevented by proper design and a careful construction. Hazards can be eliminated if the horse welfare and safety are the major consideration factors in planning horse facilities. It's well known, as a fact, that exogenous stressors for horses have to be considered boxes dimension, stud temperature, humidity and air flow ventilation (Yaras et al., 2003). Great considerations are actually dedicated also to the geographic orientation and space position of the stud and to their environmental location, without forget to avoid the so called "novelty factors"(Hada et al., 2003). This means to maintain so long so possible the regularity and intensity of feeding, grooming working, training and resting of the housed horse.

The keys of a successful horse farm are the determination of the goals of the farm and the functionality of the facilities (strictly functional, elaborated studs, etc.); these two elements agree a planning of satisfactory facilities. The programming of the structures for equestrian sports should regard: new interventions, interventions on the existing patrimony(resumption and more rational employment) and the regular and suitable ordinary maintenance of the structures(Donigaglia, 1992). It is not possible to proceed through attempt or adventures. It is necessary to start from a careful exam of the explicit needs of: horse welfare and prevention of injuries, users and the potentialities of the interested area (environment, organisation, social factors, etc.).

Many existent structures were created thanks to the initiative of "singles": this situation often determined a general lacks in the programming of intervention. In fact some riding centres are characterised by the absence of programming and functional design criteria. The preliminary design must provide conditions and characteristics allowing simple and functional conduction. It is then necessary a previous study of the specific needs and of analogous realizations. In this way it will be possible to provide a design flexible and rational accessible to the customer.

The individuation of some basic characteristics of the intervention will include a time-planned investment program with the definition of a model with the possibility of development in subsequent phases (e.g. planning of a covered riding area to realize in a second step) and the definition of correct functional relations of the designed spaces. The riding centres are generally divided in 3 fundamental sections: sporting activity; services for riders and employees; public**.** More recently horses and their needs individuate a new section which assumes a specific importance design wise as well as in managerial terms(Angioni et al., 1995).

The equestrian structures are different from all the other sporting centres because there is a join presence of man and horse with presence of differentiated functions linked to areas destined to horses, areas destined to riders and some common areas. Consequently the individuation of necessities concerns the needs of the horses and those of the riders. In the first case the spaces for the horses include studs, enclosed areas, pastures; the spaces with the horses include riding and covered ground etc., storage places(feedstuffs, bedding materials, etc.). shoeing, toilets, first aid, etc. In the second case we refer to dressing rooms, services, first aids, restoration, information, secretariat, etc.. The equestrian centres typologies include: structures located in urban areas, often linked to other sporting activities, structures located in rural areas often connected with agricultural activities, centres connected with agritourist and vacation activities, specialized centres destined to equestrian sport activities (show jumping, dressage, three days events).

Traditionally the planning of a riding centre has been always executed from the planners realizing designs from which the structures are come true effectively. The traditional design planning includes two projection size designs constituted by plans, prospectus and sections. On the other side the modern design planning include paper designs in two and three dimensions, virtual representation of buildings and figures animation(Simoni, 1998 - 2002).

The aim of this paper is to describe the planning of a riding centre destined to show jumping horses with traditional designs and with a 3-D program joined on animations to show the several advantages of the use of virtual reality and animations in planning a riding centre.

## Material and methods

The design technique includes the planning of an equestrian facility destined to 40 horses completed by the different buildings and accessories typical of this kind of facility(Angioni et al., 1995; Donigaglia, 1992, Simoni, 1998). The design realisation was

realised directly by the CAD and in 3-D Design: Autocad 2000 program in 3 D developed with program 3D max 2,5(Bacigalupi, 1998; Peterson, 1998; Leach, 2000**)**. The following step was the passage from this file to a program with which it was possible to elaborate virtual animations that agree to the observer to "move" in the equestrian centre in a virtual reality.

**Description of facilities**

The equestrian centre hypothesized by this project refers to a facility for 40 horses developed on a surface of 6ha. It includes indoor and outdoors surfaces.

**Indoor areas**

Stud: 40 boxes(3.5x3.5m); 4 boxes destined to toilet, washing(solarium) with in-out entrance; saddlery; concentrates storages; directors and instructors office; dressing room for staff.

Indoor riding ground: internal surface: 50 x 36 m**,** realized in lamellar wood.

Restaurant and welcome area: octagonal building 140m2; it agrees to welcome 70 seated persons.

Offices and dressing areas for riders: directly connected to the restaurant building.

Parking for trucks and trailers: covered lodge 45 x 6 m; closed to the indoor riding ground with special in-out course.

Garage: 25x15m, destined to jumps accommodation, agricultural machinery and maintenance shop.

Storage: 25x15m, destined to hay and bedding material.

Farriery: 25x15m, constituted by opened and closed areas.

Horse infirmary: 4 isolated box destined to quarantine.

Guardian residence.

**Outdoor areas**

Outdoor riding ground in grass with tribune: 100x100m destined to show jumping competitions.

Outdoor riding ground in sound: 75x70m.

Racetrack in sound: 10x180m long 10x120m large, placed around the riding arena in grass and the paddocks.

Paddocks: 3 paddocks 35x31; 3 paddocks 52x33m located inside the racetrack.

Ring destined to free jumping: 5x64m long; 5x20 large.

Rings: 2 rings of 15 m diameter each, the 2$^{nd}$ destined to automatic roping.

Vehicle parking: 2000m$^2$.

Dung hill: 300m$^2$.

Other external areas: destined to internal roads, horse and pedestrian pathways, areas destined to mobiles prefabricated boxes in case of participants attending show jumping competitions.

## Results

Figure 1 shows the general plan of the facility using the traditional design on paper. From this plans it is possible to observe 2 entrances: the main entrance and the lateral entrance destined to tracks, trailer etc.. Near the main entrance there is the guardian residence and the porter's lodge. The guardian residence is followed by the stud, on the right, and the

restaurant together with offices and services on the left. Close to the stud there is the indoor riding ground with the covered lodge destined to track and trailers. On the back there are the ring destined to free jumping and 3 paddocks. On the right of the stud there are the outdoor riding field, the two rings(including the automatic roping), the farriery area and the hay storage place. Close to the hay storage place there are the garage destined to jumps accommodation agricultural machinery and maintenance shop and the horse infirmary. On the right of the plan there is the race track that include the outdoor riding arena destined to competitions and 3 paddocks. Figures 2 and 3 show the equestrian centre design in 3D. This part is presented also in virtual reality and animations. The following figures show the plans details of the different elements of the facility:

figures 4 – 5 - 6: plan, prospectus and section of the stud. These figures represent the traditional designs that agree to evaluate the position of the different places together with the overall dimensions.

figures 7 – 8 – 9: 3D presentation of the stud. It agrees to have many views of the stud(outside, inside, differentiation of the places inside the stud(box, horse food preparation, etc..). The animation agrees to have information concerning the horse position inside the stud and, consequently, to verify the correctness of dimensions in relation to animal welfare.

Other examples of the 3D technique design are shown in figures 10(restaurant – bar; indoor riding ground, services) and 11(internal view of the indoor riding ground).

## Discussion and conclusion

The results of this kind of paper are not scientific. They underline, by the observation of the different realizations of the plans, the considerable innovative possibilities coming from this type of program. Obviously the paper description is not sufficient to well appreciate the 3D version and the animations. It is necessary to complete the traditional plan with the computer program. In recent years the three-dimensional designs are more and more utilised to have a complete vision of the structures. In the case of horse facilities, the three-dimensional design represents the best solution to verify, in virtual imagines, the technical choices not only for housing bur also for improving welfare conditions. This kind of technique is useful also to present the project to the customers and it agrees to realize modifications of plans in real time with consequent gain of time and budget.

The use of the 3D planning supported by animations agrees to limit mistakes in the project realization: this is fundamental when it is necessary to respect and optimize some basic aspects concerning the horse welfare. In fact it is possible to hypothesize and to virtually test the operative conditions needed both in terms of structures and welfare. The individuation of possible planning mistakes will limit the risk of modifications after the realization of the facility with considerable advantages for horses, customers, users and for designers.

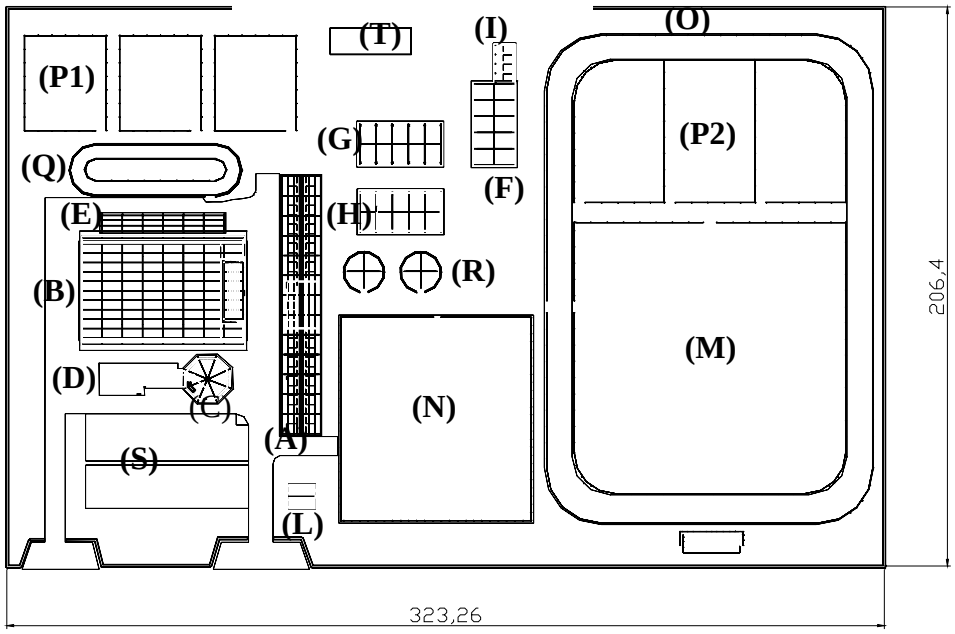
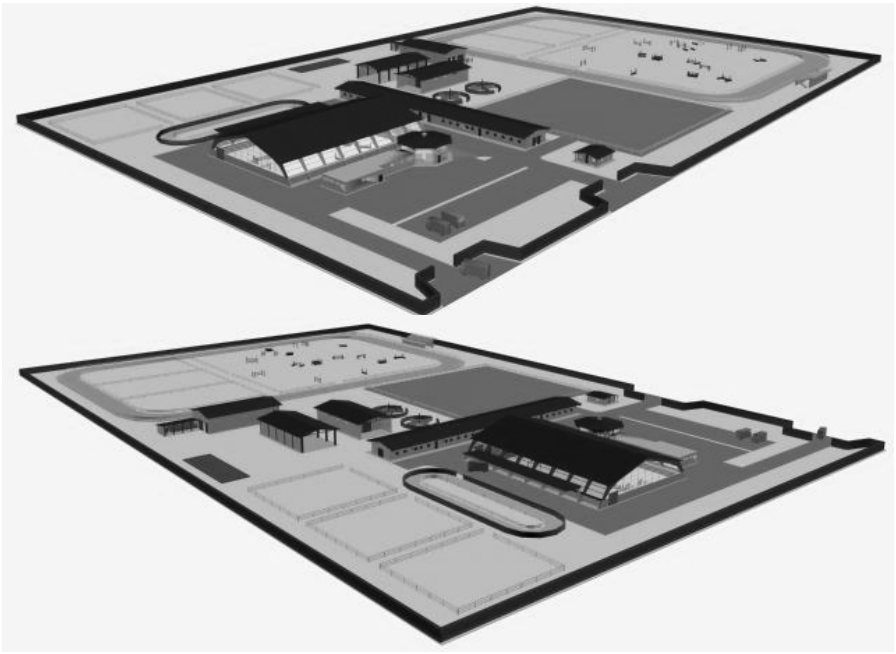



Figure. 1 Plan riding centre for 40 horses



Figures 2 – 3. Equestrian centre design three dimensional and virtual reality

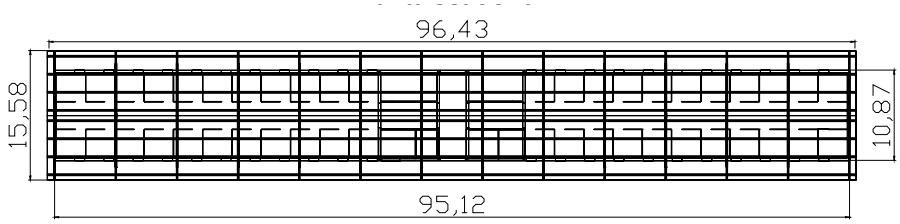



Figure 4. Plan of the studs

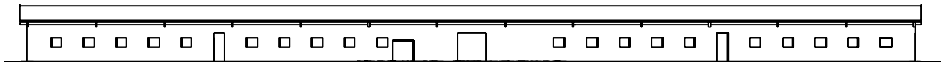


Figure 5. Prospectus of the studs

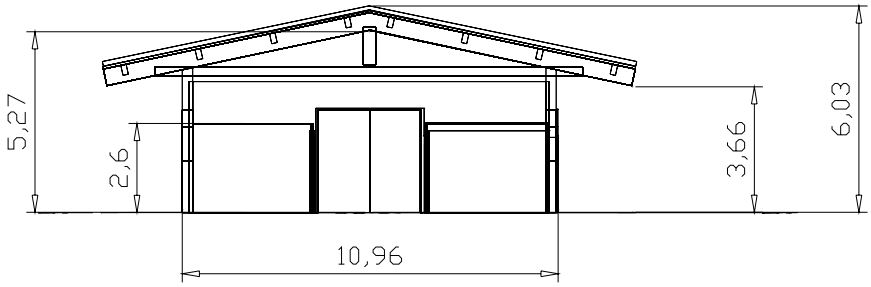



Figure 6. Section of the studs

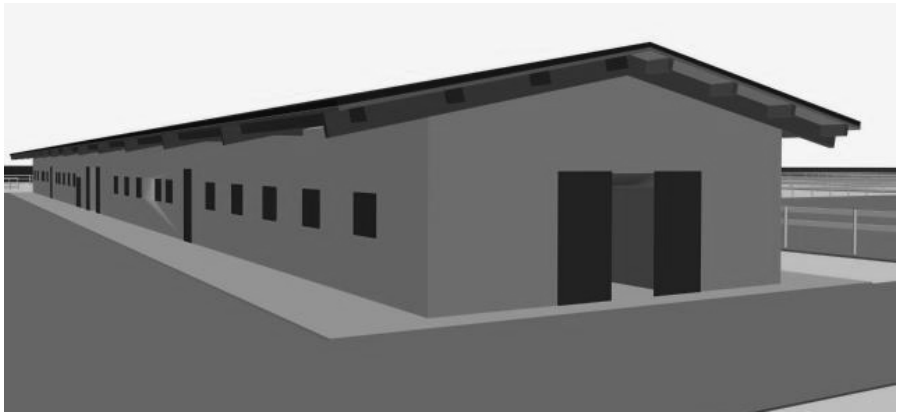


Figure 7. Outside view of studs

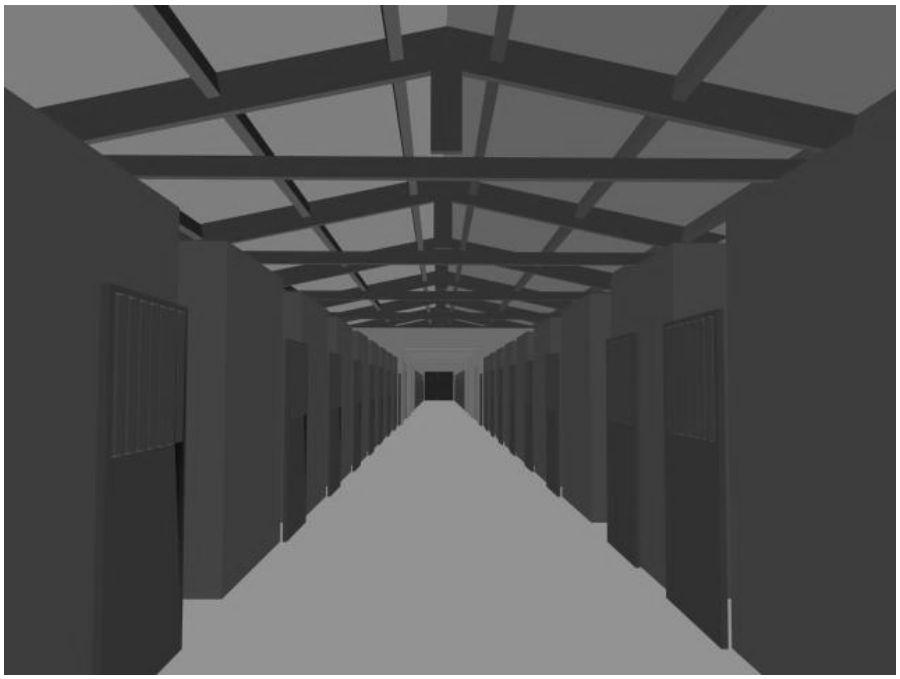


Figure 8.  Internal view of studs

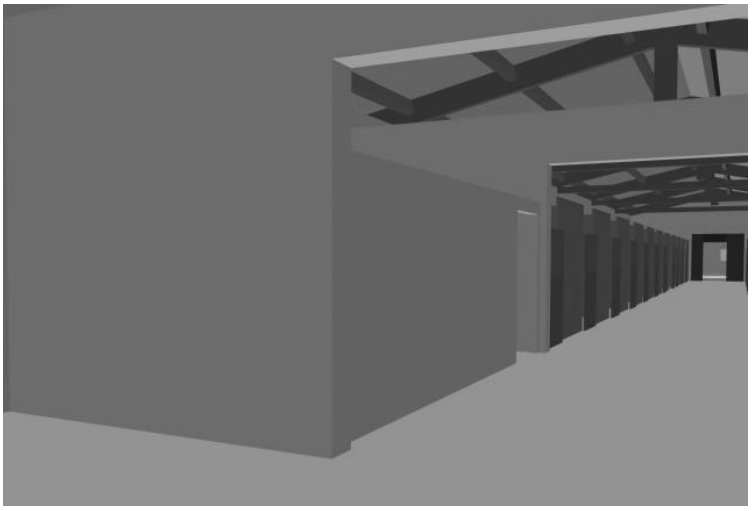


Figure 9. View of horse-food preparation  place inside the studs

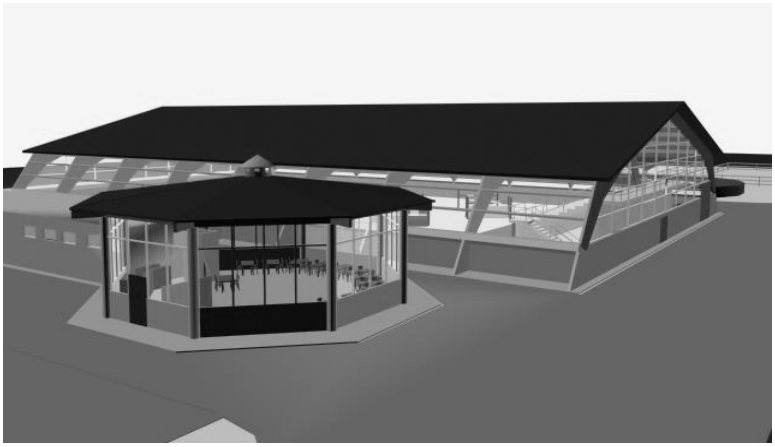


Figure 10. Resturant – bar and indoor riding area with grand-stands provided for the public and with relative services

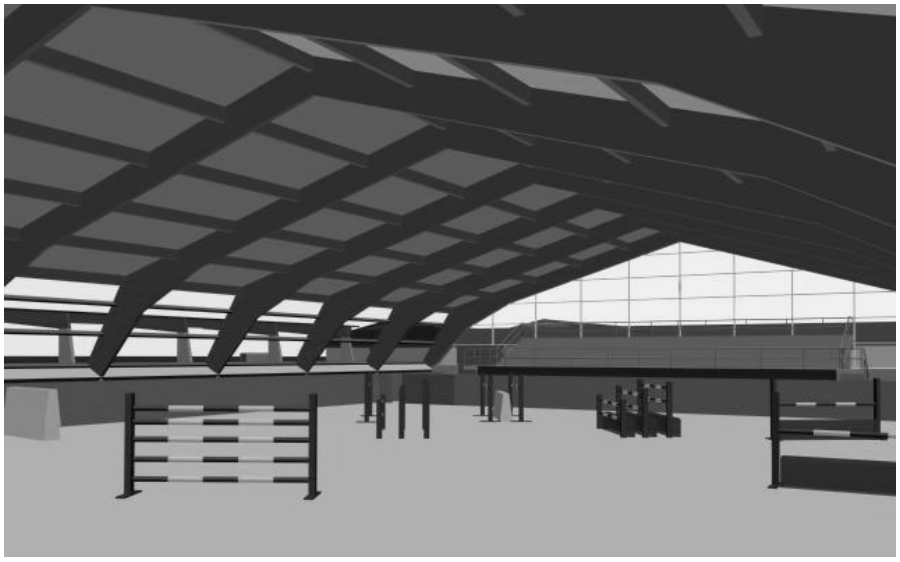


Figure 11. Internal views of the large covered indoor riding round of about 1800 m² and services

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## References

Angioni, P., M. Beta, G. Brunetti, E. Carbone, C. Croce, L. Novo, A. Paolucci, M. Reitano, M. Turner, C. Vagnozzi & U. Mezzani, 1995. Equestrian sports facilities. Spaziosport, 1, 25-104.

Bacigalupi, D., 1998. 3D Studio MAX 2.5.

Donigaglia, P., 1992. Studio per una struttura di addestramento per equini da concorso ippico. Thesis, Bologna University, Jachson Libri Ed.

Hada, T., T. Hanaka, T. Takahashi, A. Hiraga & K. Yagi, 2003. Effects of novelty stress on neuroendocrine activities and roming performances in Thoroughbred horse. J. Endocrinology, 15, 638-648.

Leach, J., 2000. Autocad. McGraw-Hill Ed..

Peterson , M., 1998. 3D Studio MAX 2. Apogeo srl.

Simoni, A., 1998. La progettazione dei ricoveri zootecnici con sistemi di grafica e animazione tridimensionali. Estimo e Territorio, 7/8, 21-24.

Simoni, A., 2002- La progettazione degli allevamenti con grafica tridimensionale, come fattore migliorativo delle scelte tecniche imponibili all'impianto. Atti IV° Convegno "Nuove acquisizioni in materia di ippologia" ,Campobasso , 103-111.

Warren Evans, J. & A. Borton, 1990. Fences, buildings and equipment. In: The Horse, J. Warren Evans, A. Borton, H.F. Hintz, L. Dale Van Vleck(editors), Freeman and Company Ed., New York, 753 – 785.

Yaras N., A. Agar, S. Gumuslu & I. Ordemir, 2003. Effects of immobilization and cold stress on visual evoked potential. Intern. J. Neuroscience, 113, 1055-1067.