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Construction systems for livestock housing and other farm buildings

Continual variations in farm product market prices encourage a desire for the ability to react instantly to market forces with new production cabability. The experience of recent months and years has shown that it is increasingly necessary, and also possible, to adjust for new production enterprises. In this context, however, the farm size and structure is of decisive importance and also the farm buildings must more than ever be designed for multifunctional use.

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A large number of farms have converted beef cattle housing to pig and poultry buildings and in the same way converted machinery or storage sheds for such use over a limited period. Against this flexibiltity is:

- first of all farm limitations (staffing, area size, marketing.....)
- of similar importance, legal building and pollution protection requirements (use changes are subject to building permission regulations!)

The design of building can also cause difficulties:

- solid masonary with load-bearing interwalling or interior supports
- lack of interior height
- approach and door dimensions unsuitable, or
- unsuitable flooring

With a new building there must therefore be a consequent decision between:

- a special design (once a pighouse always a pighouse, otherwise demolition)
- multifunctional design: clear spans, at least 4 m eaves height, no load-bearing inner or external walls.

Prefabricated sheds

Anyone building from scratch would tend towards the turnkey solution. Nowadays clearspan prefabricated sheds mainly feature steel structuring because this allows cheaper automated prefabrication instead of more expensive assembly. Standardisation in theis system also brings savings through more precise cost calculations. Through increased application of computer-supported assembly lines, however, the prices gap between standardise sheds and individual solutions is diminishing.

Normal widths of clearspan system sheds lie between 9 and 40 m with special constructions reaching over 100 m. The grid-based construction system means there is no limit to length.

With representative buildings such as riding halls or sheds with special requirements such as for salt or other chemical storage a support system from laminated timber, not so susceptible to corrosion, is preferred.

A further advantage of laminated timber against steel is behaviour in fire. The former, depending on binder cross section, is classified with F30 and F60 fire resistence, with F60 meaning the binder can withstand the fire for 60 minutes before losing its supporting capabilities. Steel can lose structural stability and collapse without warning in temperatures of just 500 °C or thereabouts.

Laminated constructions can give around the same spans as steel and are similarly prefabricated for cost-efficiencies.

The farm labour contribution in building prefabricated sheds is reduced to ground preparation, foundation work and panelling attachment. Only trained builders should undertake framework construction and this should then be under specialised administration. Usually the framework construction is erected by the shed manufacturers. Own-labour can be brought-in here, however, through offering one or two workers to the specialists.

Suitable plans for farm-labour earthworks and foundations are provided by the manufacturers. Running late in finishing the foundations means completion of the shed can be delayed by months because the firm's assembly people follow a strict timetable. Imprecise work in this context can also turn out to be expesive because the shed can only be built on absolutely level bases.

Often, second-hand sheds are offered cheap for breaking-down and removal. But purchasers should always have a certified architect look over the building because without this check it will receive no building permission and the subsequent inspection by an architect can be expensive – and complicated.

Shed design for DIY enthusiasts

Rigid frame constructione

In the past, livestock and storage buildings were often constructed around a load-bearing timber frame with strengthened angles. The timber frames were placed at spacings of 1.2 to 1.5 m. Such rigid construction binders are not transportable can, however, be completed on-site with own-labour. The frames comprise square cut timbers stiffened in the frame angles with additional wood or

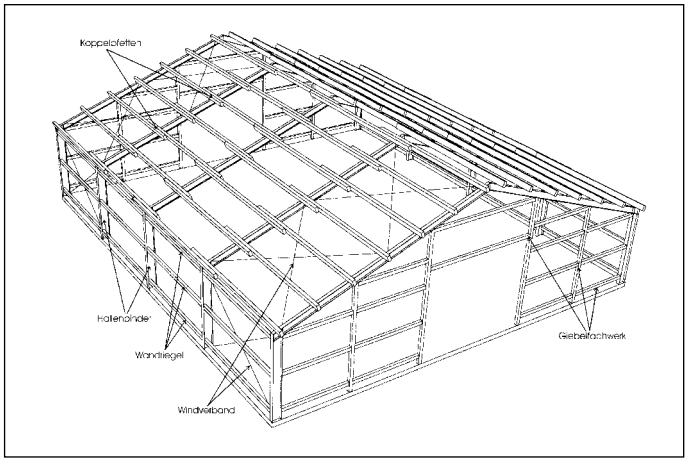

Fig. 1: The important parts of prefabricated sheds (Drawing: Meiforth)

galvanised plating attached by nails. Rigid frame constructions with architectural certification can easily allow spans of up to 25 m.

A disadvantage with this construction is that the eaves sides are difficult to close. Lateral throughways for vehicles are not realisable without special construction.

Roundwood construction

With roundwood the entire load-bearing frame is of unsquared lengths of timber. In reports on this sort of construction sketches often show fine-looking cylindrically-turned lengths of wood. However the reality with fresh farm-felled trunks is completely different, with squint, uneven lengths often circumferentially inconsistent. Using such building material requires much skill and time.

To ease building with this material one can order prefabricated frame components of galvanised steel plating from a south German firm. In particular there can be a problem with the roof in that the cladding panels must be attached onto an even framework.

If one builts a roundwood shed with own timber using a joiner for all work, the resulting cost is often similar to that for the same size of joiner-made building including timber costs.

Pole barns

A pole barn features supporting poles sunk into the ground bearing roof trusses of square-section timber instead of roundwood – or with laminated or fach-timber trusses and rafters. Distance between supporting rows of poles can be dependent on ground and roof span and may be up to 6 m. A 5.5 m ridge height should not be surpassed.

To achieve the required span the poles should be inserted into 45 - 60 cm diameter and 1.5 m deep boreholes. The space between borehole walls and poles is filled with concrete. Only roundwood poles which have been pressure-impregnated with creosote (telephone poles) should be used. Experience has shown that these have a lifetime of 25 to 30 years. Where ground conditions are unfavourable the poles should be supported with steel brackets fixed into individual foundations.

Short component lesson for roof and walls

Roofing

Fibre-cement panels should be favoured more than profile metal sheeting for roofing because up to 18% of the fibre-cement panel volume can absorb condense water and thus avoid dripping in normal situations. Coatings on profile metal sheets aimed at reducing condensate dripping have unfortunately never been able to achieve this aim satisfactorily, nor do they offer any cost efficiency because of their higher manufacturing costs.

For pure machinery sheds, roofing with condensate-prone profile sheeting doesn't represent such a problem but it should always be born in mind that the buidling might be used for intermediate storage of grain or converted later for pig or cattle housing when the condensation dripping would be a problem.

Wall cladding

Type of wall construction depends on shed use and associated structural requirements. Aesthetic aspects should also be considered in the planning – although these do tend to lead to extra expense. Where the walls do not have to bear any horizontzal loads from loose heaps, light profile metal, timber or fibre-cement cladding with the required underconstruction should be sufficient in most cases. With timber, care must be taken that the wood is pressure-impregnated against pests damage.

Profile metal cladding should be mounted as far as possible without material damage so that there are no scratch areas where corrosion can start. Coated metal panels must not be cut with an angle-grinder as this action burns the zinc galvanisation and leaves open sections liable to rusting.

Table 1: An overview of costs for prefabricated sheds and individual work aspects. The sums presented represent average company prices inclusive of purchase tax.

Prefabricated hall with ~ 4.5 m eaves height, 15¡ roof angle, fibre-cement roofing and light wall panelling- without flooring plates	65.— to 90.— €/m²
Roofing:	
Trapezoidal profile metal panels including understructure	15.— to 25.— €/m²
Fibre-cement panels including understructure	25.— to 35.— €/m²
Wall elements:	
Wall construction (bricking) grouted both sides	75.— to 110.— €/m²
Trapezoidal profile metal including underconstruction	12.— to 20.— €/m²
Timber lining panelling underconstruction	30.— €/m²
Fibre-cement panels including underconstruction	25.— to 35.— €/m²
Flooring:	
Compoind stone plaster mechanically laid	25.— to 35.— €/m²
Concrete flooring including packing	45.— €/m²
Compoind stone plaster mechanically laid	55.— €/m²
Electro-connections in detail:	
Earth cable 380 V, laid, capacity 60 — 120 kVA	30.— to 40.— €/lfm
Standanrd connection price for 380 V connection	1 500.— €
Small electricity control point 250 kVA	15000.— to 25000.— €
Standard connection charge for 380V connection	1 500.— €
Medium current-earth cablel (leading to electricity control point)	40.— to 50.— €/lfm
Connecting electricity control point to	5 000.— €