The construction of golf greens

WHAT is the best type of construction? To understand this better, it will help to discuss the recent history of green construction on the less than ideal sites which are all that is generally available today. It is rare to be given an ideal links or sandy heathland site for a new course. Generally it is a stretch of heavy agricultural land which is hardly either ideal golfing country, nor particularly well drained naturally.

My involvement in golf course construction goes back to the late 1940s working with that genius of an architect Mackenzie Ross, first in Scotland then in Belgium. There was then a long period when few new courses were built in Britain, until the boom starting in the sixties, when I returned full-time to golf advisory work.

I was horrified at what I found - even in those days I advised that greens sited on heavier land be built on stone carpets, though this was regarded as an expensive and generally unnecessary luxury. The usual method then was to lay down a herring bone drainage system, if anything, topped with local soil, finishing with 2" seedbed compost. No wonder we have so many poor courses with even worse draining greens.

Even when stone carpets became more generally used - as opposed to using them only on wet sites, mistake followed mistake. Earth moving equipment was used, with no regard for its destructive effect on soil structures in root zones; churning up approaches and causing insoluble problems with drainage. Even then much too heavy soils were used - always on the grounds of expense. Some of those early courses twenty five years ago were built for under £10,000 - and never was soil imported. Worse still, the wrong 'stone' was used - and the fatal results of using limestone or lump chalk particularly, on acid heathland sites, was proven when greens had to be lifted and relaid within a few years of construction. The chalk fizzed away quietly to itself, breaking down into a wet, plastic and totally impermeable base, with obvious results on drainage and turf.

cheap construction

These errors were made in the interests of cheap construction on the false grounds that what one did not spend, one did not have to earn. Yet correct construction, though more costly, always turns out to be cheaper in the long run. It bears constant repetition that drainage is our main problem but this must be achieved without creating an unnatural ecology, which has to be maintained artificially and very expensively - and which, as in all knife edge situations, is bound to come apart at the joints sooner rather than later. The two extremes can be reconciled by proper specifications, selection of special sandy soils for the root zone and avoidance of compaction during construction. Merely running a series of drains under a green is no answer. At best the drain lines show in a drought and at worst they drain only a narrow zone on each side of the drain. Therefore, logically the green must be built on a raft or stone carpet which is itself efficiently under-drained but the surface effect of such drains is masked by the raft.

Constructional compaction is still the prime fault of many courses built in the past twenty five years. Building by hand e.g. with wheelbarrows and spades is obviously out, if only because of the high cost, yet it is fatal to use earth moving equipment in areas where special drainage is essential. It has always been the most important constraint in my specifications that no wheeled or tracked vehicle must be used on future putting surfaces or aprons. However this increases costs. Therefore a compromise has been successfully reached in recent years - and it is significant that no greens built to these specifications have proved to be unsatisfactory, in contrast to others.

no argument

There is generally no argument about basal construction - namely that the base of the green should be excavated with a valleyed contour to shed any water which reaches it, laterally, to a shallowly inserted central spine and alternate and opposite herring bone drainage system, with flexible perforated plastic drains and pre-formed junction units, run to a proper outfall and not just, as so often happens to a small sump sited in the most important area of all, five yards in front of the green, creating a soggy bog and giving impossible run-up conditions. This excavation and construction can safely be carried out with earth moving equipment as the base does not need to be permeable and indeed it is an advantage for it to be consolidated and stable.

The arguments start with the selection of material for the stone carpet. Whilst various grades of gravel may be theoretically effective as drainage they fail the practical construction test because gravel is so 'fluid' that it moves under
traffic, and sinks into the base of the green. It is essential for the success of this method of construction that angular stone be used because of its stability.

**Heap of stone**

Once the base is graded out, and the drains inserted and topped by hand with the same stone as for the carpet, after blinding them with finer stone or gravel, then a heap of the specified stone is dropped into the centre of the green, with a Hymac or similar long jibbed excavator. This machine is then moved, sitting stationary on that levelled pile, to introduce and level the rest of the stone carpet to conform to the finished contours of the green.

In many cases, there is limited local choice about the stone, but it must never be decomposable, soft sandstone and certainly never lump chalk or limestone. A size between 2"-3" or 3"-4" depending on availability, is ideal. Hard sandstone, gritstone, whinstone, granite, 'main-line ballast', flint reject from cusher-run have all proved successful. Small gravel has not, as it is unstable, and the only way for it to give good results would be to use a drag-line excavator to introduce it! Of course, there are large voids - intentionally - and of course the stone must be blinded, with a material naturally varying with the stone used, so as to be compatible and preventing infiltration of the root zone mix, again ranging from clean 'sharpl ash, clinker or smaller grades of stone or coarse gravel - and even to the extent of using two, compatible, graded blinding layers in the case of large stone.

The secret of good greens is to try to copy what is under the best natural turf - virtually a humus enriched light sandy 'soil' - but containing within the meaning of the Act no clay and very little silt. This does not mean mixing peat and sand! The ideal mix comes from deep alluvial deposits in East Anglia's often overlying gravel and derived from old, long since drained, lakes. It has been shipped in bulk to Ireland, the north of Scotland and the extreme South West. This fen soil is diluted with 70% - 80% sand of a specified grain size and uniformity and produces a consistent uniform root zone. More importantly, the subsequent top dressing can be carried out with exactly the same material.

**Uniform layer**

It is vital that the root zone layer is absolutely uniform if roots are to develop to its full depth. This means mixing the fen soil and sand off site, and never on the green site itself. Rotating in peat or even fen soil into sand already introduced will never achieve the homogenous mix which is vital to success. Pockets of sand, or worse still, peat or humus-rich soil can have disastrous effects on the overlying turf. The sketch shows the methods - but experience influences the results. This is a vast improvement on the old method of using local soil however much diluted with sand. Clay plus sand makes bricks. Only a decade ago some advisors were still recommending 2' of 'seed bed compost' over a local soil base (with or without stone carpets). Needless to say the roots never ventured into the unfriendly world below, and with this encouragement surface rooting annual meadow grass soon displaced the sown grasses.

If golf courses are to be built well and cheaply they must be built quickly. Of course, if you can afford to spend six weeks or more building one green, using hand work only, then gravel may be one answer but the end result is the needless spending of money. Courses costing £1 million and more, even if most of this has been spent in massive earth-moving of the
the construction
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site to make it conform to the
called architects
preconceived ideas ("Identikit
courses" I call them), will
certainly never see a
satisfactory financial return on
the expense. To build well and
cheaply means building
quickly and this means
mechanisation. This is
impossible on gravel - and even
less so with pure sand.

very few courses
There are in fact very few
courses where the greens have
been built with pure sand - most
are with humus-enriched sand
or a sandy soil - and not one of
these pure sand greens has
stood up to the test of time.
It is fashionable to claim it was
the use of the wrong materials
or bad specification which was
responsible for the poor results
with sand greens, but whilst the
use of binding angular,
concreting sands made disaster
inevitable, it is the concept that
is wrong in the first place, and
with it, the management which
is enforced by this type of
construction, virtually
hydroponics i.e. growing plants
without soil. This ensures that
in the absence of any limiting
climatic factors e.g. very hot
summer temperatures, annual
meadow grass is bound
to dominate under our
main enemy
Annual meadow grass is still
our main enemy. We do not
have to live with it. It is not
inevitable unless management
(past or present) is or has been
wrong. But if you build greens
the wrong way you have lost the
battle before you start.
There are of course many finer
points of construction - and one
is the need to insert the horse-
shoe main serving the pop-ups
into the base of the green (the
perimeter of the stone carpet)
without risking subsequent
damage to the pipes, and at the
same time avoiding
unacceptable disturbance of the
prepared seed beds.
A plea is made to Architects not
to indulge in flights of fancy
with exaggerated contours.
Mackenzie greens are all very
well, but their inventor, who
used the two-tier green to
accommodate a green into a
steep slope, stated that such
greens must be at least 800 sq.
yards in extent, to compensate
for the fact that well over a
third of the green area was not
available as pin space.

always difficult
Management of the slope is
always difficult, not just
mowing and the attendant risk
of scalping, but also because
everything sheds to the lower
level - fertilizer, top dressing
and above all water. With such
greens pop-ups can at best
provide only the basic
minimum needs of the low wet
areas and the ridges have to be
topped up by hand-held open
hose, with penetration aided by
hand aeration and the use of
wetting agents.
Common errors with this
construction are in the depth of
the root zone which must vary
no more than between 9"-10"
- just deep enough to sink a hole
cup. One contractor who
skimped construction costs and
ended up with 6" soil, tried to
resolve the problem by
supplying 18 shallow hole-cups
on the course he built some
years ago!
This of course emphasises the
need for constant and regular
site supervision and total trust
between architect and
contractor if success is to be
assured.
Surrounds to greens must also
receive almost as much
attention as the putting
surfaces, though they are not
normally built on stone
carpets. Common faults are
artificially steep, skimped
mounds instead of bold but
gentle contours, mowable by
triple mower; coupled with false
economy in soil preparation.
Improved soil must be used, at
least 6" in depth, after
constructing the mounds
integrity with the green.

care & protection
Approaches - perhaps second in
importance in turf quality only
to the greens - need care and
protection to ensure perfect run-
up conditions - with virtually
no botanical difference between
them and the green itself - only
in the height of cut. This means
not only keeping all
construction machinery off
these vulnerable areas, by
working from the back and
dores of greens wherever
contours or site boundaries
permit, but in much more
attention to seed bed
preparation.
I prefer seeding to turfing
though in case of need e.g. the
course having to be ready for
play when an hotel opens or
investors wanting to see the
quickest return on their money,
turfing is feasible now that we
have better quality-control on
'cultivated' turf. When seeding,
use the newest strains of
Agrostis and fescue as they are
proven to be so much better -
(see the STRI Turf Grass Seed
1988 lists) and if you must
economise use less, not cheaper,
seed. We generally seed too
heavily - which can help to keep
out stray grasses - but the best
method is of course to sow only
when the soil is warm and
moist (i.e. late July to mid
September), as a quick
establishment will produce the
best results - well worth waiting
a few weeks for - especially if
the intervening time is spent on
cleaning the seed bed. I recommend that surrounds and approaches are sown with exactly the same (expensive!) mixture as the putting surfaces, since after all we want no difference in the end result. How often one sees quite good greens and yet a foot off the putting surface, there is a thin open poor sward, with severe contamination from raking pulled off the green and not collected! I cannot stress too much the importance of perfect marrying-in between apron and green itself. I am sure there will be many who will push rival claims for alternative construction methods, but do remember one thing! This method is not only proven, but by far and away the largest numbers of courses in good order were built to this specification in the past decade and more, and none has needed lifting and all have given satisfaction as well as fine grass dominance, where management has been correct. I fully admit that not every new course with which I have been involved in the past twenty years is still successful but in every such case, my advice was over-ridden for the sake of saving perhaps £5-10,000 in original construction costs, we are now faced with costs in excess of £100,000 for rebuilding them (and all the disruption). It pays handsomely to do it right first time. There is no mystery about good course construction any more than with good greenkeeping - just a case of using logic and commonsense to achieve the right end. There seems to me to be neither logic nor commonsense in using systems that have been devised to meet the special needs of arid desert areas totally different from anything found in the U.K.

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