Landform Grading Building Nature's Slopes

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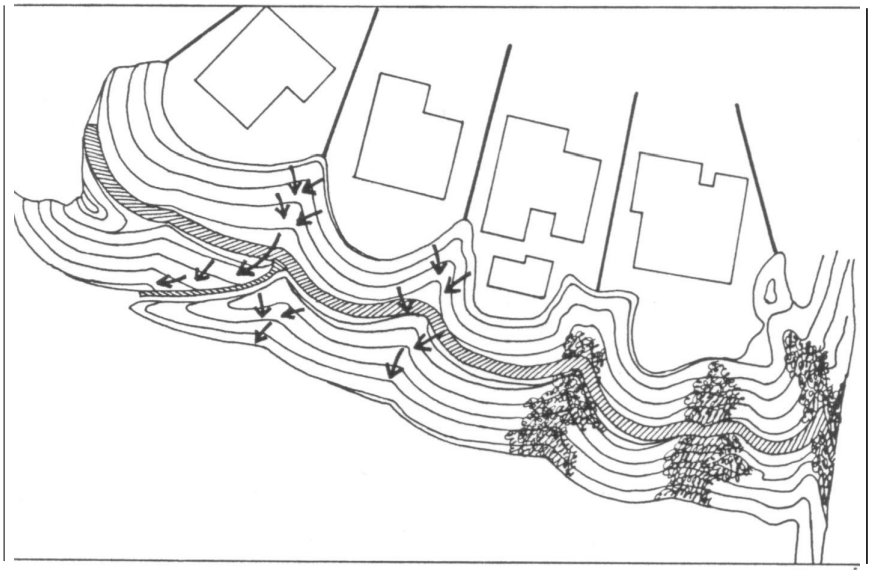
The advantages and necessities of hillside living are becoming more widely evident as flatlands — the traditional building sites — are consumed by housing, industry and agribusiness.

However, hillside building can require massive grading that may become the focal point of local resistance, thus impeding planning approval. The innovative "landform" grading method was born of negative impressions gained in viewing the conventional, linear slopes commonly manufactured throughout the building industry.



TOPOGRAPHICAL *REPRESENTATION* of a section of landform-graded slope, showing radial water flow, foliage placement in swales and redistribution of land on lots to conform with landform configurations. Hatched area is concrete terrace drain required *by* building codes.

Anaheim Hills is situated in 4,300 acres of beautiful, undulating hillsides in northeastern Orange County, California. We, like every other developer, were taking natural terrain and transforming it into rigid, mathematical shapes for building. It was a practice based on the idea: "We've always done it that way." Since there was no specific reason, other than expediency, why it was being done, the time had come to examine ways of changing the accepted thinking about mass grading. The search for an alternative was an attempt to improve the aesthetics of graded hillsides. Anaheim Hills agreed to finance the experimentation and to use the results in the community.

There seemed to be no reason we couldn't grade the slopes to resemble natural slopes. The question then arose: what do natural slopes look like? Curiously, there was no published information about slope shapes as a total unit We were on our own.

Project research involved study of slopes in such diverse areas as Death Valley, Brazil, Alaska, Hawaii and Anaheim Hills in an attempt to separate distinct features from among the natural slopes and to determine if there was any relationship between climate, soil type and vegetation and slope configuration. Yet it was two years before distinct, repeating patterns emeged from the jumble of forms. Simply stated, cones, pyramids, "elbows," ridges and various combinations of these elements produce natural slope shapes.

The challenge was now to apply these basic shapes to the grading process. Could they be designed and graded? We would have to retrain everyone concerned with the project. Designers, engineers, grading contractors and public officials had always worked in straight lines. Now we were saying, "the more irregular, the better."

Communication of the new ideas was difficult at times. Initially we made clay models in which we combined the basic slope shapes and took them out to the civil engineers and grading contractors. They, in turn, conveyed the ideas to their equipment operators in the field. However, the grading was not shaping up as we expected. We finally had to go into the field and call a bulldozer operator off his machine, show him the drawings and photos and explain the ideas. He then said, "Sure, I can do that. Why didn't you say that in the first place?" With each grading project, we improved and streamlined the operations.

We've now been doing the grading in Anaheim Hills for seven years. Contractors experienced in landform grading prefer it because the finished product doesn't need to meet precise slope-angle measurements, and it affords the operator more leeway in his bulldozing.

There is less finishing cost to the contractor, although there are more engineering, design and field control costs in landform grading. The cut and fill slopes are very complex to design. It is an art to assemble the various shapes on the slopes so they won't look unnatural. They have to blend together and work structurally. Landform grading gets its look not from one component shape or one gully but from a series of them. The landform shapes become a sequence of undulations, peaks and gulleys.

We have to deal with three planning commissions in Aanheim Hills: the cities of Anaheim and Orange and the County of Orange. The planners are delighted with the landform grading idea. At first they were doubtful, but once we'd graded several slopes, we invited them out for a look. Thev walked over the slopes, viewed them from different angles and saw the value of what we were doing.

The civil engineers were more skeptical. Thev felt that the shapes we were creatine would cause severe erosion. We proved them wrong. Earlv on, we graded an experimental slope 70 feet high without the artificial drainage interception aids required by the building codes. Rather, we let the curves and elbow shapes of the landforms absorb the im-

pact of the running water, as happens in nature.

The rains from 1977 to this year have been heavy. From September through March 1977-78, it rained more than 31 inches. The same period in 1978-79 gave us more than 21 inches, and 1979-80 during the similar months put more than 22 inches of water on the slope. The slope is still in perfect condition. Nature doesn't follow building codes, but its designs still work.

Ironically, we found that conventional, angular grading tends to encourage erosion. Water generally will sheet flow on a flat surface and will tend to carve swales in the weakest sections of the slope. To compensate, building regulations require terrace drains every 25 feet to break the momentum of the water. Yet there is an entire set of building regulations predicated upon the efficiency of conventional, linear slopes.

On the other hand, the drainage pattern of a landform-graded slope is radial in nature and swales are already provided for the runoff. If the land is formed naturally, as in our process, the water follows the channels, which break its speed by virtue of their energy-dissipating shapes. Further, most foliage occurs in the channels or swales, and its presence breaks the speed of the running water. Our landscaping also follows this natural pattern. We also experimented with such ideas as planting Acacia Rosemary, a lush, low growth, to cushion the impact of rainfall.

Mother Nature is full of surprises. She knows how to control erosion without using the clumsy terrace drains we use in man-made slopes. We've minimized the visual impact of the required concrete drains by running them diagonally and curvilinearly across the slopes, which makes them considerably less visible. We also line them with river rock, so when they are visible they complement the landform slope aesthetics.

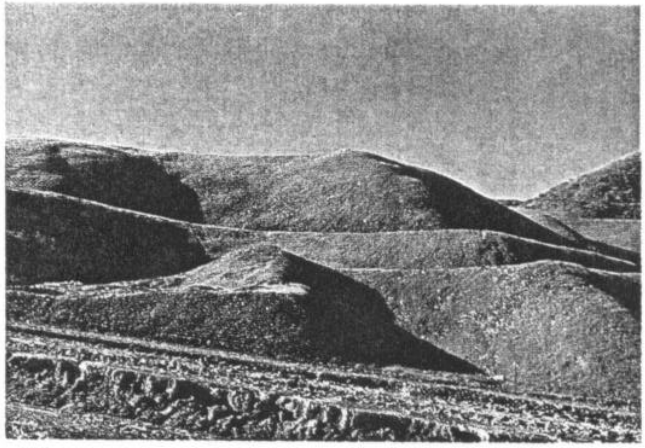
AERIAL PHOTO of landform-graded region in Anaheim Hills. Note irregular patterns formed by landform-graded slopes along perimeter of lot pads.

Initially, we and the builders were concerned about the buildable land that would be lost to the landform grading process on each lot. We solved that by reshaping backyards to conform with the grading configurations. The center sections of the lots, which are used most extensively, bulge outward with the ridgelines of the grading. The corners of the yard are taken up by the swales and these edges are characteristically used less often. In effect, we redistributed the lot pad square footage to our advantage.

We are pleased with the results of our experiments. When covered with mature vegetation, our landform graded slopes appear very much like natural slopes. The grading has allowed us to move away from straight lines and abrupt angles in our community planning. The homes are positioned more irregularly, which discourages the monotonous look of row housing. And, importantly, we come very close to restoring the slopes to their natural conditions.

We believe that sooner or later developers will be required to use this type of landform grading. This method of grading is part of the future of land development in this country and eventually in all other countries because most urban and suburban flatland has been built upon in one way or another. Landform grading involves more effort to achieve, design, implement, construct and engineer. However, the cost in time and labor is well worth the results of aesthetics, structural integrity and the value to developers of public acceptance and municipal planning approval.

FRESHLY GRADED landform slopes show ridges, swales and pyramid shapes.



MATURE LANDFORM slopes with vegetation and foliage in swales.