

Delta Design THE DESIGN TASK

Architect's Primer appended.

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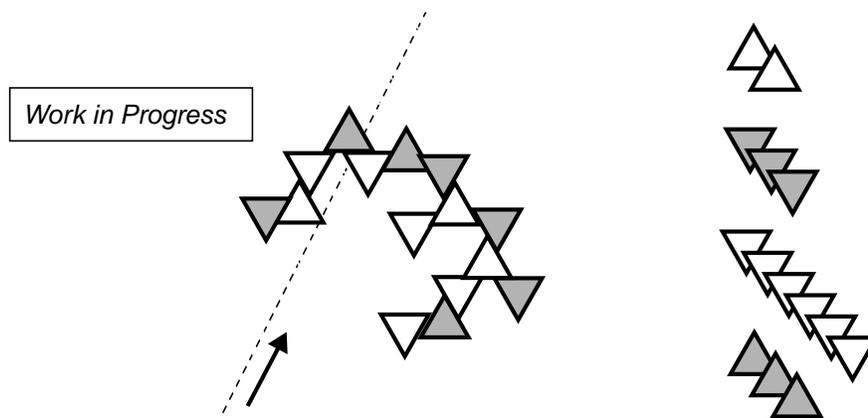
1.1 Introduction

Congratulations! You are now a member of an expert design team. Your collective task will be to design a new residence suitable for inhabitants of the imaginary Deltoid plane. These written materials, provided to help you prepare for this task, are organized in four sections.

The next section provides an overview of life on the Deltoid plane, DeltaP as it is known to the natives. The following section describes your team, and the final, your design task. A second handout, different for each team member, provides the specific information you will need to perform the role you have been assigned within your team. Each team member will contribute different expertise to the project, and each has different design responsibilities to fulfill. All must work together for your team to create a first-rate design.

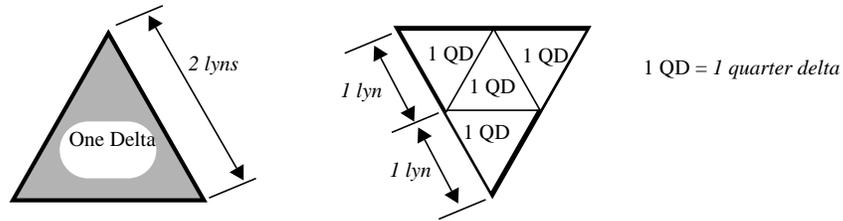
1.2 Life on DeltaP

Life on DeltaP, residential and otherwise, is quite different from what you have grown accustomed to here on Earth. First off, DeltaP is a plane, not a planet, so your team will be designing in two-dimensional rather than three-dimensional space. If your design "meets spec" and is considered attractive and functional by your Deltan clients, one view on a single sheet of paper will convey to those responsible for constructing it all the information they need to do so.



The view on this single sheet may not be quite what you expect, however, because in addition to lacking a z axis, Deltoid space has unfamiliar relations between the x and y axes as well. What we think of as “perpendicular” is hopelessly skewed to a Deltan, and vice-versa. In our units, a right angle on DeltaP measures 60° or $\pi/3$ radians. Thus all sides of an equilateral triangle form lines considered perpendicular to all others. If there were such a thing as a “circle” on DeltaP, it would be composed of only $4\pi/3$ radians.

But there is no such thing as a “circle” on DeltaP, nor even the concept of continuity embodied therein. In this flat though angular world, residents construct their artifacts strictly with discrete triangular forms. Of these, the equilateral triangle -- with its three perpendicular sides (!)-- is considered the most pleasing. Accordingly, your team will design the residence by assembling into a



cluster the most prized building materials on DeltaP, equilateral triangular components called “deltas.” Deltas come in red and blue versions and always measure 2 lynes per side. Four “quarter-deltas”, *QDs*, triangular units of area measure with sides of 1 lyn , fit within a delta.

Lynes? QDs? Not surprisingly, Deltan systems of measurement are as unfamiliar as that for spatial coordinates. Table 1 summarizes the measurement schemes on DeltaP that you will need to know to carry out your design task.

All of DeltaP’s units of measure share the divisibility and extensibility conventions of the metric

TABLE 1. Measurements on DeltaP

Measurement	Unit of Measurement	Symbol
Time	Wex	wx
Distance	Lyn	ln
Area	Quarter-Delta	qd
Heat	Deltan Thermal Unit	DTU
Temperature	Degrees Nin	$^\circ\text{Nn}$
Force	Din	Dn
Moment	Lyn-Din	LD
Currency	Zwig	!

system; in the measure of time, for example, there are both microwex (μwx) and megawex ($M\text{wx}$). In relation to the attention-and life-spans of Deltans, these units are roughly equivalent to seconds and years, respectively, here on Earth.

As building components, deltas have functional and aesthetic characteristics that are more complex than their simple form and even dimensions would suggest. Especially when assembled into a cluster, as you will be doing, they behave in interesting ways. Deltas conduct heat among themselves, radiate heat to outer space, melt if too hot, and grow if too cool. Red deltas produce heat. All deltas are subject to DeltaP’s two-dimensional gravity (which is itself subject to axial shifts during DeltaP’s not-infrequent gravity waves). Three different kinds of cement are needed to join them together, and joint alignment with respect to gravity affects ease of production as well as

structural integrity. Different colors and different quantities of deltas cost different amounts of money per delta, and can be assembled in clusters that are either exceedingly ugly or very attractive to the Deltans. Your task will be to create a design that meets prescribed goals for all of these characteristics.

1.3 Design Team Roles & Responsibilities

Your design team is organized such that each of you will be responsible for a subset of the design goals. One of you will be PROJECT MANAGER. Your main concerns will be with cost and schedule, the interpretation and reconciliation of performance specifications, and negotiations with the contractor and client. You want to keep costs and time-to-build at a minimum, but not at the expense of quality. When your team submits its final design, the project manager must report the estimated cost (in zwigs) and the time (in wex) that it will take to build.

Another of you will be the STRUCTURAL ENGINEER. Your main concern will be to see that the design “holds together” as a physical structure under prescribed loading conditions. You must see to it that the two points at which your structure is tied to ground are appropriately chosen and that continuity of the structure is maintained. When your team submits its final design, the structural engineer must attest to its integrity by identifying the strongest and weakest joints, and estimating the average load on all joints expressed as a percentage of the failure load.

Another of you will be the THERMAL ENGINEER. You will want to insure that the design meets the “comfort-zone” conditions specified in terms of an average temperature. You must also ensure that the temperature of all individual deltas stays within certain bounds. When your team submits its final design, the thermal engineer must estimate internal temperature and identify the hottest and coldest deltas.

Finally, one of you will be the ARCHITECT. Your concern is with both the form of the design in and of itself and how it stands in its setting. You must see to it that the interior of the residence takes an appropriate form and that egress is convenient. You should also develop a design with character. When your team submits its final design, the architect should be prepared to present a sketch and discuss generally how and why the Deltans will find the residence attractive and functional. The architect will also be asked to estimate a few more quantitative measures of architectural performance.

The following section describes the specifications that your design must meet to be accepted by your clients on DeltaP. Familiarize yourself with these specifications. Then, for schooling in your specialty, turn to the separate primer you have received that discusses the science and technology of your domain. The primer contains the knowledge and heuristics you will need to estimate the design parameters for which you are responsible. If you have questions that it does not answer, do not hesitate to ask. You should be expert in your role before your team begins the design phase.

1.4 The Design Task

Your Deltan clients have cleared the space shown on the site map and come to your team with their need for the design of a new residential cluster. The cluster itself must meet the following specifications.

The client wants the cluster to provide a minimum interior area of 100 QDs (Each diamond on your girded site map defines an area of two QDs). The shape of this space, which can of course exceed the minimum, is a matter of design. The client has expressed enthusiasm for the newer

The Design Task

mode of segmenting interior space, a mode that breaks with the two-equal-zone tradition and values the suggested privacy of nooks and crannies. Still the space must be connected, i.e. no interior walls can cut the space into completely separate spaces. There must be one and only one entrance/exit.

The client is known to be color sensitive blue; too much blue brings on the blues, so to speak. No more than 60% blue ought to be allowed; certainly blue deltas are not to exceed 70% of the cluster.

The residence, as all clusters, must be anchored at two points and two points only. There is a limit to the amount of force each anchor can support, as well as to the amount of internal moment each joint can withstand. Exceeding either limit would cause catastrophic failure and send the unwary residents tumbling into the void. The cluster should be designed for a life of thirty megawex. Gravity waves, rare but always possible, should be considered.

The average interior temperature must be kept within the Deltan comfort zone, which lies between 55 and 65 °Nn. The temperature of the elements themselves must be kept above the growth point of 20 °Nn and below the melt-down point of 85 °Nn. Delta temperatures outside of this range will result in catastrophic structural failure with little more warning than excessive load.

All of this -- design, fabrication and construction -- must be done under a fixed budget and within a given time period. At your team meeting you are to develop a conceptual design that meets or exceeds all design goals. When each team submits their design, individual members will be asked to report design performance on parameters for which they are responsible.

TABLE 2.

Summary of Design Specifications

Functional Internal Area	100 qd
Maximum Cool Deltas (% Total)	60-70%
Average Internal Temperature Range	55-65 °Nn
Individual Delta Temperature Range	20-85 °Nn
Maximum Load at Anchor Points	20 Dn
Maximum Internal Moment	40 LD
Overhead Factor -K	(varies)
Total Budget	! 1400.00

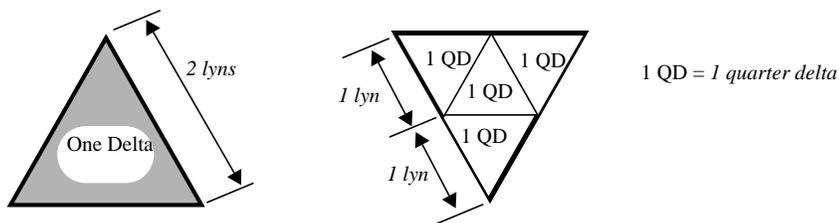
Delta Design ARCHITECT PRIMER

1.1 Introduction

As architect, your concern is with the intrinsic form and function of your team's design, as well as how it relates to the site. When your team submits its final design, you should be prepared to discuss how and why the Deltans will find the residence attractive and functional. You will also be asked to report some more quantitative architectural measures discussed below.

1.2 Function Follows Form

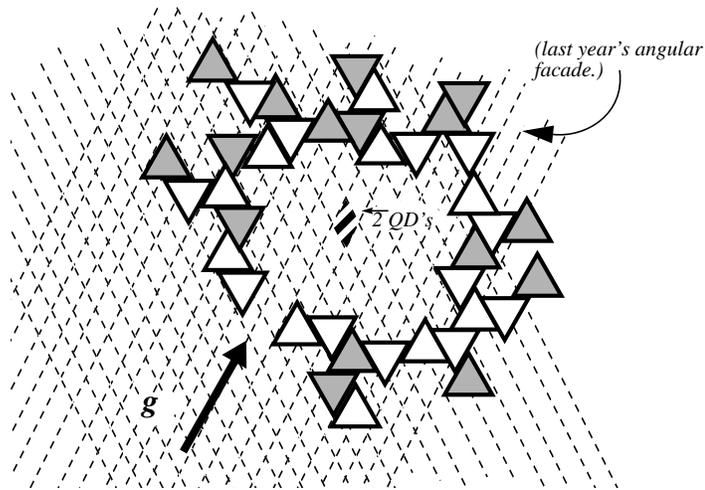
As simple as the fundamental building elements appear, quite complex, intricate and angular form can be composed out of deltas. As architect, it is your responsibility to create design that not only meets the clients' physical needs but in some way stands as an expression of their vision of themselves and their community.



You read this vision as a vision of progress and innovation. You imagine a form that, while rooted in tradition, suggests a reaching out toward the unknown. Tradition has valued the angular exterior facade. You want to experiment with the smooth. Perhaps a rhythmic alternation of a

Some Quantitative Measures

smooth facade over a finite number of lynes with the traditional angular exterior will prove interesting



Coming more into vogue is the angular interior. There is some kind of reversal going on here. The interior traditionally has been made smooth, to maximize interaction and communication. Nowadays privacy has become a common word in architectural discourse. While an argument can be made that the use of deltas to shape interior nooks and crannies is an inefficient use of this one resource, you think that this is a short-sighted view even though it is a view "rationally" argued by your engineering colleagues.

Your clients want to go even further. They seem to want some kind of "fractal" interior -- not just one space with nooks and crannies but sub-spaces which themselves suggest nooks and crannies. This is all very fuzzy in your mind but you are keen to experiment and have started sketching.

At the same time, you are keen to economize on space designated for circulation within the interior. You want, in other words, to maximize functional space. Note that a quarter-delta is an area within which three inhabitants could stand and talk comfortably, one to another. Several lynes are then required for circulation cross-section, not only within the interior but also at the entrance.

The single entrance/exit is conventionally aligned with the force field and "upstream" as viewed from outside; that is, one enters the cluster moving forward, in the direction of gravitational pull. This is so because Deltans are themselves subject to gravity. They have evolved over the many *gigawex* of their existence to the point where they now are able to maneuver in any direction without conscious attention to the force field. However, the entrance to most clusters is located so that the residents would fall into rather than out of the cluster if they were to lose this sense. This orientation is essential during passage of a gravity wave.

As noted in the description of the design task, your client is blue sensitive. While the allowable dosage of blue deltas in the environs is no set number, you conjecture that the blues ought not to constitute more than 60% of the elements. Dispersion of the blues is preferred as well, so that residents are not confronted with seemingly endless blue vistas when viewing the interior.

1.3 Some Quantitative Measures

Although the Deltans will ultimately judge the quality of your work by stepping back and casting a critical eye at the overall design, they have also requested that you provide some simple measures of design quality. These measures, and the methods to use to figure them, are as follows:

Some Quantitative Measures

- *Internal Area*: Estimate the internal area (in QDs) by using the grid on the site map. Each diamond has an area of 2 QDs.
- *Blueness*: Calculate the blueness of your design by figuring out how many of the deltas used are blue, expressed as a percentage of the total.
- *Blue Dispersion*: Count the total number of joints between deltas where either or both are blue. Now count how many of these do not join two blues, and express the result as a percentage of the total. 100% would mean you had achieved perfect dispersion.
- *I/E Perimeter Ratio*: Measure the interior and exterior wall lengths in lins and divide the interior length by the exterior. Because a craggy wall will be longer than a smooth one, the higher this ratio is, the better you have met the clients desires discussed above. Certainly this ratio should be greater than 1.

A final note: unless told by the instructor that you will be remodeling the clients' existing residence rather than designing an entirely new one, you as architect are responsible for putting forward an initial configuration for consideration by your design team.