What to Expect from Your Engineering Firm

Your engineering firm should be a detective fully able to unearth all the secrets of land under option.
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Published online 09-20-2005

Shopping center developers should press as hard as they can to squeeze out all the possible information available to them regarding any land site under consideration for purchase or development. The fact is that the land holds no secrets. Someone highly experienced and knowledgeable of the full range of potential land development issues can provide a developer with all the information needed to make an informed decision whether to exercise an option on virtually any piece of land.

If enough engineering research is done early in the process, a developer will have sufficient information in a detailed preliminary site engineering report to know whether or not to exercise a purchase option based on knowledge regarding these key issues, among others:

• What is the amount of earthwork (including the movement of on-site fill or bringing in off-site fill) required to balance the site and prepare it for development?

• Are storm water quality and quantity issues manageable?

• Are there any soil issues that will impact site development?

• How will wetlands and other factors impact the amount of developable land?

• Will any environmental and ecological issues slow development or reduce profitability?

A thorough preliminary site engineering report completed up-front while the land is under option to purchase is an expenditure that could save a developer 10 to 100 times that amount because of the knowledge that it provides. Using actual case histories, here are some examples of what developers can learn about their selected building sites.

What is the amount of earthwork required to balance the site and prepare it for development?

Since balancing a site is not only crucial to its efficient and timely development but also because there can be significant costs involved in balancing using on-site resources versus bringing soil from off-site, the preliminary engineering report can be a source of substantial importance.

The earthwork can be extensive on a major shopping center mall site. In one case, preliminary engineering studies and final design spanned 3.5 years. The preliminary design phase included 18 iterations of grading plans all associated with different site plans. The existing topography of the site, with more than 130 feet of relief as well as numerous environmental constraints, made earthwork on the site a challenge. The final balanced grading plan resulted in earthwork excavation quantities in excess of 2.3 million cubic yards.

Often, earthwork balancing of the site can be done without the substantial expense of hauling dirt from off-site. One case study shows that a mall developer initially received a recommendation to haul a substantial amount of dirt off-site in order to balance the site. An alternative to that recommendation was later submitted by another firm as part of its peer evaluation requested by the mall developer. This second opinion resulted in a recommendation to move 800,000 cubic yards of dirt on-site with no off-site hauling. The overall savings from the second recommendation totaled about $7 million.

Are storm water quality and quantity issues manageable?

A preliminary engineering report should be able to inform a developer of vital information regarding the “lay of the land” so that more is known relating to requirements and costs impacting storm water management.

Take, for example, a selected shopping center site that is virtually flat. In this case, one that has only 29 feet of elevation relief from side to side. Surface flow, of course, would be expected to be poor. For a site like this, storm water detention would be a major concern and would receive substantial attention in the preliminary engineering report. Fortunately, most of the related issues could be addressed early in the process.

In this case, the developer would be made aware of the need for open-air channels to be built to handle the 100-year flood elevation and pass water through the site to a nearby lake. On-site storm water could be conveyed around the site in sewers, which would expel into detention basins. The detention basins would have a permanent pool elevation of at least 4 feet for this site to ensure the removal of pollutants through settling and biological uptake.

Take another example with even less elevation — a site that has only 10 feet of elevation relief from the central high point to the elevation of wetlands which surround a majority of the site. The lack of relief, heavy cover and the very permeable soil result in little or no runoff from the 2- and 10-year storms.

In this case, nearly half the site is designated as wetlands. The site plan proposes a very aggressive land use, leaving minimal developable lands for storm water management purposes. Deep detention areas, the engineering report concludes, are not feasible since the ground water depths are assumed to be close to the surface (as evidenced by the presence of large wetlands) and there is little relief to the site. Insufficient volume remains in the above-ground storm water detention basins to provide all of the detention volume. As a result, the preliminary report recommends that underground storage be utilized to satisfy the storm water regulations that govern the site. A total of five above-ground detention ponds and three underground infiltration/detention areas are proposed to detain up to the 100-year storm.

For storm water quality on this site, storm water will be treated through the use of a total suspended solids (TSS) removal system. This removal system, which is an engineered storm sewer structure similar to a catch basin, in conjunction with a street sweeping program, will satisfactorily meet the 80 percent removal regulations that govern this site.

Are there any soil issues that will impact site planning and development?

Soil conditions also can have a significant impact on the maximum amount of developable land. Soil boring data taken early during the option phase, before purchase or immediately after purchase, is necessary to better understand the developmental challenges to be faced.

A geotechnical report will provide important information regarding subsurface conditions, ground water information and rock information. The result of that report will have a strong bearing on how best to develop the land and whether the soil provides competent support for structures and roadways or whether additional soils will need to be brought in from off-site locations.

It is possible that initial site document research will show that a preliminary soil investigation was conducted several years prior to the potential purchase and that soils extracted at that time indicated the soils are competent for the support of structures and roadways. Yet, new engineering findings may indicate the need for an updated soils report.

The engineering firm should research all available, pertinent information dealing

with the site history and even information dealing with land contiguous to the site. The engineering firm and the client need to consider the importance of the information, how current the information is and whether the information as detailed and conclusive as needed.

To cite an example of such a situation, in a 1987 soils study, 11 initial borings were made ranging from 5 to 20 feet in depth. The new preliminary engineering report recommended soil analysis to include borings of 20 feet beyond the finish grade in cut areas and 15 feet in fill areas or to refusal. Also, the preliminary engineering report suggested that monitoring wells be included as part of the updated soils report and that more borings be incorporated, approximately one per every 5 acres of the site to obtain a more accurate understanding of the site. The original borings indicated that the top 10 inches of the site contained sandy topsoil with organic material, the soil below the topsoil to 6 feet deep contained fine to medium sand, and the remaining depth of the boring contained silty clay and clay soils.

The engineering firm should not overlook available information but also may decide not to rely solely on the information if it is deemed to be less complete than needed. In the case of soil borings regarding soil conditions, for example, it could be that the available information signals what the engineers consider to be a significant concern but find that theinformation available is not as conclusive as needed because of the nature of the project.Thus, further and immediate research is recommended regarding soil conditions in this case.It is possible that the further steps are needed because the information is not as complete as needed or that tools available for gathering information are now more sophisticated and likely to provide better answers on which to base project development decisions.

How will wetlands and other factors impact the amount of developable land?

Wetlands may take anywhere from under 10 percent of a potential mall site to more than 50 percent. Additionally, local regulations may set up buffer zones around the wetland area, further reducing the amount of developable land.

A mall site in Massachusetts had a gross area of approximately 129 acres. Of that, approximately 58 acres (45 percent) were reserved as open-space wetlands. The preliminary engineering report cited that buffer zones also had been designated surrounding the wetland areas. This required that there be no disturbance inside a 25-foot buffer zone and no structures inside a 50-foot buffer zone.

In another instance, wetlands represented a substantially smaller percent of the total site — a site of 283 acres with approximately 32 acres reserved as open wetlands. The preliminary report delineated that these wetlands included a mix of high-quality forested wetlands, young forested wetlands, low-quality wetlands and approximately 10,600 linear feet of linear or “drain” wetlands. The breakdown regarding these wetlands provided the developer with insights regarding the maximum amount of developable land.

The high-quality wetlands would have to be considered untouchable, since they have the presence of blue heron rookeries. The linear or drain wetlands could be relocated on-site as long as off-site flows were contained in open-air channels. Young forested and low quality wetlands could be filled. On-site wetland mitigation would consist of 1.5:1 replacement ratio for shrub, emergent/wet meadow wetlands, 2:1 replacement for forested wetlands and 1:1 replacement for linear drain wetlands.

Another potential early warning to be gained from a preliminary engineering report is the identification of floodplain issues, which could reduce the amount of developable land. A careful review of available documents could indicate that no flood plain elevation is assigned to the planned site area, although a floodplain restriction does exist at a nearby land area.

In a case like this, if the portion of the land that is to be developed is above the floodplain elevation, then it might be possible to obtain a FEMA (Federal Emergency Management Agency) LOMA (Letter of Map Amendment), which states that certain portions of the land lies above the floodplain elevation. If it cannot be concluded that the area is outside the floodplain, there will be a need to hydraulically restudy the area and obtain a LOMR (Letter of Map Revision), which is a letter from FEMA stating the floodplain line has been changed due to fill placed in the wetland. Because of floodplain evidence in the adjoining land parcel, it may be assumed that the floodplain will continue into the low-lying portion of the selected mall site. Thus, a preliminary engineering report would set off a warning

signal to the developer that further research should be done to assess this assumption and to identify the limits of the floodplain. The map revision process could take as long as 18 to 24 months.

Will any environmental or ecological issues slow development or reduce profitability?

Consider the decisions that must be made by a developer with an option to purchase land in the following situation: the developer wants to build a shopping center with that land sitting atop a former landfill. Again, this developer can gain a great deal of knowledge about the site condition and its challenges from information detailed in a preliminary engineering report.

In this case, the preliminary report documented facts regarding that this development's design would need to include landfill gas mitigation measures with the installation of a landfill gas collection and extraction system beneath the foundation. The design also would need to address future compaction below the structure that would take place in the future. Pilings would need to be driven through the landfill and into the underlying aquifer. Additionally, certain underground utilities serving the facility would need to be anchored to the pilings to minimize the potential for ruptures, which could result from settlement of the refuse. Systems components of the gas monitoring and control system would include a gas barrier, a gas extraction system and a gas monitoring system.

Additionally, the preliminary report pointed out to the shopping center developer that the development plan should include a off-site monitoring well to monitor contaminants associated with the landfill. One of the several aquifers near the landfill showed contamination with a variety of pollutants resulting from the landfill and other activities over the past. The developer was cautioned that approval might be required from the state environmental department for new construction.

These actual case studies and the suggested preliminary engineering report outcomes and conclusions have been selected to provide a general overview of how shopping center developers can know more about the land they are purchasing. And as a result, developers can use their time more efficiently to bring more dollars to the bottom line. Truly, the land holds no secrets. In fact, the land favors the developer by putting virtually every detail out in the open so it can be considered early in the purchase and development process.

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