

# Earthworks Advantage

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Optimization technology generates dramatic savings on site development costs.

Moving dirt is not cheap—in terms of either energy or dollars. That’s why civil engineers at Nave Newell used site optimization technology to cut quantities of export fill in half when designing a 12-acre commercial site owned by Poplar Realty Investments, LP in Malvern, Pennsylvania. The result was approximately \$1 million in client savings.

The plan called for a three-story, 86,400 square-foot office building and associated parking spaces. However, the tightly constrained site presented unusual challenges. The property directly bordered a railroad on one side, and was hemmed in by steep slopes along the other three sides. In addition, the site contained a secondary driveway that could not be moved. Then, after the Township of Malvern had already reviewed and approved the preliminary plans, the Pennsylvania Department of Transportation required Poplar to widen an adjacent road. Given the site constraints, this new requirement jeopardized the previous design solution and volume study.

“Adding the new lane would put the earthwork far out of balance. We had a significant amount of export fill, so much so that it would have been cost-prohibitive,” says Paul DiGiacobbe, P.E., principal and director of engineering automation at Nave Newell, Inc., located outside Philadelphia.

Engineers at Nave Newell used SITEOPS® site optimization technology to generate a better solution and the results were impressive. The new, optimized site design shifted the Finished Floor Elevation (FFE) by three feet, reducing the quantity of fill for export by half—approximately 50,000 cubic yards. DiGiacobbe estimates the savings in site development costs at roughly \$1 million.

While a “balanced” earthwork site is commonly pursued by developers, it may not always be the least expensive option. Site optimization considers earthmoving and materials costs and site constraints to determine the optimal design solution. The design solution may include a combination of earthmoving and retaining walls.

“We thought we were pinned into a corner, with incredibly difficult site constraints. Then we find out we have \$1 million of wiggle room,” says DiGiacobbe. “That’s a significant savings.”

## How It Works

Site optimization technology was developed using problem-solving techniques from the discipline of predictive analytics, a subfield of artificial intelligence. One of the reasons that the SITEOPS software was chosen for the project was that it is the first commercial software application to apply these findings to business problems in land development.

The result is a web application with capabilities that extend beyond typical CAD drawing tools. New users are often pleased to learn that the software can automatically draw numerous site design elements such as parking lots and truck drives. As with BIM tools for vertical site construction, users can dynamically update the properties of site elements after placement.

“Engineers get excited when they see the product in action, because SITEOPS makes it easy to quickly change site constraints and cost data.

By automating routine drafting tasks, the application lets design professionals do more engineering and less drawing,” says Mike Detwiler, CEO of BLUERIDGE Analytics, whose company produces the technology.

Site optimization analyzes billions of layouts, grading, and storm water drainage alternatives to generate the most cost-effective solution for the project. To get started, users simply upload a DWG file with the site’s topography and property line to the SITEOPS web server. Site constraints, site costs, and additional site information layers are reviewed and revised, as needed. Civil engineers use the application’s real-time simulator to see the effect of simple layout changes—for instance, changing a building location or the orientation of parking spaces.

Next, an engineer submits a project for optimization. Within 24 hours, the SITEOPS server returns three to five cost-optimized preliminary site designs (in DWG format) containing 30 layers of information, each with its own takeoff cost report in Excel spreadsheet format. Users can run unlimited optimizations for a single project to enhance the design and run “what if” scenarios. The application can also generate Site Cost Optimization Reports (SCOR reports), which compare cost and design data for different design solutions. These reports give engineers and clients an easy way to review the cost impact of multiple design options side-by-side.

Even apart from the cost savings achieved on projects such as Malvern, developers are requesting the application as a decision support tool—because it gives them better information months earlier in the design process. Site

development costs are notoriously difficult to predict and typically represent 25 percent or more of a project's total budget. By having this essential information as part of their pro formas from the beginning, developers gain a stronger negotiating position with property owners, banks, and tenants.

"SITEOPS eliminates surprises, which usually come in the form of dirt problems," says land developer Tim Dockery, principal of The Crown Companies. "Even if grading optimization saved no site cost dollars, it would be worth it—it just so happens that it does save money and it does expedite the process."

The flexibility of the software is also valuable for land developers seeking to incorporate more sustainable design features into their projects. For instance, engineers can adjust the design to designate tree saves and other set-aside areas. Further, the application includes the ability to specify semi-permeable concrete, by altering the runoff coefficient.

#### Next Steps

DiGiacobbe reports that with the results of the site optimization in hand, the outlook for the project shifted considerably. "In these difficult economic times, reducing site costs is crucial to the success of a project."

Engineers at Nave Newell created a new plan for storm water and grading based on the optimized design. As of August 2008, the Malvern project is in the final phases of permitting, with construction expected to begin within the next six months.

DiGiacobbe said that he is optimistic about the potential of site optimization technology to reduce energy expenditures and site development costs on future client projects.

"This has been revolutionary. It changes the way we position ourselves to our clients. It changes our offerings. Now we're able to add the estimated site cost and do earthworks. This changes the game."

The dollar impact of reducing time and energy spent on earthmoving during site development is not difficult to grasp. The environmental impact of reduced fuel and emissions is also noteworthy. A typical 175-horsepower bulldozer emits as much particulate matter as 500 cars, according to the Environmental Protection Agency.

Saving resources and saving money often require difficult tradeoffs. As engineers at Nave Newell discovered, site optimization represents a powerful way to create more efficient sites—delivering higher value to clients and with greater design flexibility. SLDT