



## APPLICATION GUIDE:

# Alternate Support Methods for Build Optimization

TIME REQUIRED ■■■ COST ■■■ SKILL LEVEL ■■■

By Jesse Hanssen, Stratasys, Inc.

### OVERVIEW

Optimizing performance becomes increasingly important as a project moves from prototype application to direct digital manufacturing (DDM). With larger production quantities, even a small decrease in material consumption and build time can have a large impact on production expense and throughput.

With a few minor adjustments to the default parameters for FDM supports, DDM applications can have times and material volumes cut in half. And since the methods are so simple to apply, it is just as easy to save time and money on the prototypes made for product development.

#### Co-developers:

- Harald Friz, alphacam
- Frank Schaefflein, Stratasys, Inc

#### Applies to Materials:

ABS, ABS-M30, PC-ABS with WaterWorks supports

### METHOD 1: FAST-BUILD SUPPORTS

To decrease both build time and the volume of support material, increase the distance between the support material rasters. The larger air gaps will decrease build times by up to 22 percent and decrease the volume of support material by up to 40 percent (table 1).

	DEFAULT STYLE		REDUCTION: FAST-BUILD	
	Build Time (hours)	Material (in3)	Time (hours)	Material (in3)
Sample_1	31.42	68.78	4.72	18.89
Sample_2	58.27	136.51	5.61	16.46
Sample_3	8.95	6.61	0.17	0.74
Sample_4	42.57	53.83	2.42	6.86
Sample_5	21.13	61.06	0.28	1.21
Sample_6	33.15	89.82	7.30	30.42
Sample_7	5.77	5.82	0.32	1.65

Table 1: Time savings of 20 percent and material reductions of 33 percent are possible with the simple application of the Fast-Build support style.

# ALTERNATE SUPPORT METHODS FOR BUILD OPTIMIZATION

## 1. CREATE CUSTOM GROUP:

Select the SupportSparse template and save it as a new custom group named SupportFast (figure 1).

Change the Air Gap between adjacent rasters (figure 2) to 0.79 inch (20.0 mm). Also, adjust the Start Angle to make it perpendicular to that used in the SupportSparse group. For example, with ABS-M30 and a T16 tip, the Start Angle would be set to 150 degrees. Next, set the Delta Angle to zero degrees and check the box for Align Rasters.

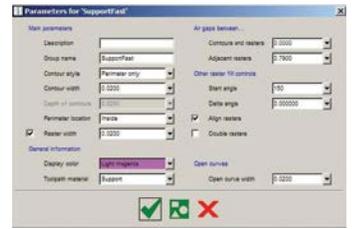


Figure 1: Create a new custom group for SupportFast.

## 2. APPLY CUSTOM GROUP:

Apply the SupportFast group to any SupportSparse groups that are more than ten layers below the Support curves (figure 3). Leave the ten-layer boundary of SupportSparse curves unchanged.

The ten-layer region acts as a buffer zone that ensures that all faces of the model are properly supported. At the transition between SupportFast and SupportSparse, the raster will sag because of the larger air gap. This sag lessens with each subsequent layer. By the tenth layer, the sag is eliminated, which provides a flat contour for the subsequent support material curves.

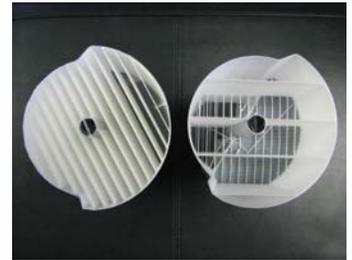


Figure 2: Default raster air gap (left) is increased to 0.79 inch (right).

## METHOD 2: SUPPORTS MADE FROM MODEL MATERIAL

Another alternative to decrease build time is to substitute model material, such as ABS-M30, for the support material. Making both the model and support from a single material eliminates the lag when switching between materials. If combined with the Fast-Build supports method, build times can be reduced by as much as 40 percent (table 2).

	DEFAULT STYLE	REDUCTION: Fast-Build + Model Supports
	Build Time (hours)	Time (hours)
Sample_1	31.42	6.05
Sample_2	58.27	5.70
Sample_3	8.95	3.12
Sample_4	42.57	3.75
Sample_5	21.13	2.33
Sample_6	33.15	10.03
Sample_7	5.77	2.09

Table 2: When combined with the Fast-Build support style, using model material for supports can slash build times by more than 30 percent.

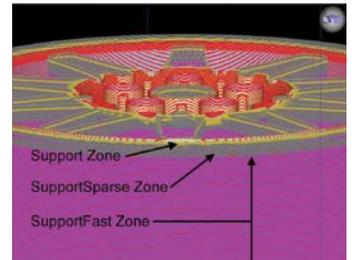


Figure 3: The ten-layer SupportSparse zone (gray) acts as a boundary between the Support zone (gold) and the new SupportFast zone (purple).

This method is simple to implement. However, it is not applicable for every FDM part. To be effective, all supports on a given layer must be made from model material. Also, the geometry of the supports must be such that they are not captured by the part. Although the WaterWorks™ support zone allows the support to release from the part's surface, removal will be difficult if the model or supports surround each another.

# ALTERNATE SUPPORT METHODS FOR BUILD OPTIMIZATION

## 1. CREATE CUSTOM GROUP:

Select the SupportSparse template and save it as a new custom group named SupportModel. The only parameter to adjust is Toolpath Material. Set this option to “model” (figure 4).

## 2. COMBINE WITH FAST-BUILD SUPPORTS:

Optionally, SupportModel can be combined with the Fast-Build method described above. To use this option, add a custom group named SupportFastModel. Use all of the parameters for SupportFast but set the Toolpath Material to be “model.”

## 3. APPLY CUSTOM GROUP:

Both SupportModel and SupportFastModel are applied to any support material curves that are three or more layers from the SupportFace curves. This two-layer boundary of soluble support material allows the supports to separate from the part when submersed in the WaterWorks solution.

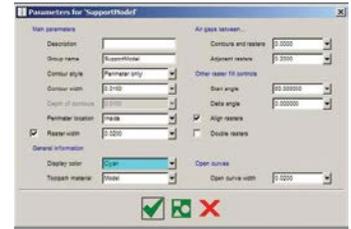


Figure 4: Create a new custom group for SupportModel.

## FDM PROCESS DESCRIPTION

Fortus 3D Production Systems are based on patented Stratasys FDM (Fused Deposition Modeling) technology. FDM is the industry's leading Additive Fabrication technology, and the only one that uses production grade thermoplastic materials to build the most durable parts direct from 3D data. Fortus systems use the widest range of advanced materials and mechanical properties so your parts can endure high heat, caustic chemicals, sterilization, high impact applications.

The FDM process dispenses two materials—one material to build the part and another material for a disposable support structure. The material is supplied from a roll of plastic filament on a spool. To produce a part, the filament is fed into an extrusion head and heated to a semi-liquid state. The head then extrudes the material and deposits it in layers as fine as 0.005 inch (0.127 mm) thick.

Unlike some Additive Fabrication processes, Fortus systems with FDM technology require no special facilities or ventilation and involve no harmful chemicals and by-products.

**stratasys**

E info@stratasys.com / STRATASYS.COM  
ISO 9001:2008 Certified

### HEADQUARTERS

7665 Commerce Way,  
Eden Prairie, MN 55344  
+1 888 480-3548 (US Toll Free)  
+1 952 937-3000 (Intl)  
+1 952 937-0070 (Fax)

2 Holtzman St., Science Park,  
PO Box 2496  
Rehovot 76124, Israel  
+972 74 745-4000  
+972 74 745-5000 (Fax)