CNC CONCEPTS, INC.

The Optional Stop

Spring 2002

Tips For Fanuc Control Users From CNC Concepts, Inc.

Issue 51

44 Little Cahill Road Cary, IL 60013 Ph: (847) 639-8847 FAX: (847) 639-8857

Where is your current constraint?

We offer several training products aimed at helping CNC users better utilize their CNC machine tools. Topics include Setup Reduction, Cycle Time Reduction, and Maximizing CNC Utilization. In each of our courses, we've always assumed that students work in companies that could benefit by becoming more productive with their CNC machine tools. But one question always comes up: "How do I choose a place to start improving?"

Admittedly, some CNC environments are so complex that it can be overwhelming to pick one machine/process that makes the best (or even a good) starting point. In our setup and cycle time reduction courses, we simply state that if a machine is in setup for a greater percentage of available production time, then start with setup reduction for that machine. If it is running production for the greater percentage of available production time, start with cycle time reduction. While this may be a reasonably good rule-of-thumb for a specific machine that you wish to improve, it still begs the question "Which machine/s should you start with?" In this article, we're going to offer a more logical way to determine which area of your company (or which specific machine) makes the best one to start with when it comes to improving productivity. Note that we're making the entire company fair game for potential improvements. Many improvements will not even involve CNC machine tools.

Why do you need to improve?

We're going to assume that your company needs to increase its output without increasing operating expenses. This translates to getting more output with your current resources. While there are other reasons why a company must improve (we'll state some later), our discussions related to constraints apply only if your goal is to increase output.

You must begin by locating your company's current constraint. Here's how we define the current constraint.

The current constraint is the entity that limits maximum output at the present time.

Constraints can be viewed at different levels. They can be viewed from the perspective of the entire company, from the perspective of one department or group of departments (possibly a manufacturing cell), or from the perspective of but one machine tool.

Let's further clarify. The company-wide current constraint is the entity that limits the company's total output at the present time. The entity could be a department within the company, a group of machines, a single machine, or anything else that limits the company's maximum total output.

In similar fashion, a department-wide current constraint is the entity (cell, machine, person, etc.) that limits a department's total output at the present time. The current constraint for a single machine tool is the entity that limits the machine's total output (usually the machine or its operator).

Again, the company's complexity determines how difficult it will be to locate the current constraint. Think of constraints as being like bottlenecks and they should be pretty easy to spot. If talking about the current company-wide constraint, what department in the company is currently falling behind, holding up production in other areas? Find the department that has the largest backlog of work, and you've probably found the company-wide constraint.

In some cases, finding the current constraint may simply involve determining which process takes the longest amount of time to complete. While we may be oversimplifying to some extent, the longest of two or

In This Issue:

Subscription Information:
The Optional Stop is published quarterly by CNC Concepts, Inc. and is distributed free of charge to people downloading it from our website (www.cncci.com). Back issues are available, but a $10.00 charge per issue will apply to any back isues not currently published on our site. Back issues 1-50 are available for a total of $199.00.

more processes will likely be the constraint.

The primary goal of improvement

The primary goal of any improvement program must be to improve total output. On a company-wide level, we're talking about the company's total output. On a department-wide level, we're talking about the department's total output. On a machine tool level, we're talking about the machine's total output.

If you have correctly located the current constraint, improving will increase total output (from the company, department, and/or machine). While improving an area that is not the current constraint may have benefits, it will not improve total output.

If you improve the current constraint, again, total output will increase. If you improve enough, this improved entity will no longer be the current constraint. Some other entity will become the current constraint. We call this process "eliminating the current constraint". Once a constraint is eliminated, another will appear. When you find it, your goal will be to eliminate it as the current constraint. When you do, yet another constraint will appear. You'll locate it and eliminate it as the current constraint.

Eliminating constraints is an on-going battle. It doesn't end until everyone is satisfied with the current output level (of the company, department, and/or machine).

An example of finding the current constraint

Though our example is pretty simple, it should nicely illustrate how to locate the current constraint. You may, however, find this to be pretty obvious.

Our example workpiece producing company has three departments, including mill department, lathe department, and grinder department. The general flow of workpieces includes some work in each department. First, raw material is turned in the lathe department. Second, some secondary operations are performed in the mill department. And third, all workpieces require a grinding operation in the grinder department.

To improve on a company-wide basis (increase the company's total output), we must first locate the department that is the current constraint. Say, for example, that through-put time per workpiece is three minutes in lathe department. In mill department, through-put time per workpiece is four minutes, fifteen seconds. In the grinder department, through-put time per

workpiece is five minutes, twenty seconds.

In this case, of course, the grinder department is the current constraint. If all departments are working the same amount of time, workpiece production lots are probably stacked up in the grinder department, waiting to be worked on (remember what we said about bottlenecks).

If you intend to improve this company's total output, you must, of course, work on the grinder department. While there may be some benefits to improving the lathe and the mill departments, doing so will not improve the company's total output.

Once you determine that the grinder department is the current company-wide constraint, you must find the current department-wide constraint in grinder department. Maybe an excessive amount of scrap is being run on a given machine, making it the current constraint for the department. If you find a way to eliminate the scrap, you can eliminate this machine as the current constraint. Of course, some other entity in the department will then become the current constraint.

By the way, if this machine is truly the current constraint for grinder department, any improvements you make for it will have an immediate impact on the company's total output.

Maybe your improvement caused the throughput time for grinding department to drop from five minutes, twenty seconds to four minutes, forty-five seconds. This means that the grinder department is still the current company-wide constraint. You must find the (new) current constraint in grinder department and eliminate it as the constraint. Say you notice that one inspector is checking all workpieces coming through the grinder department and this person is not able to keep up with all the machines in the department – so inspection is the current constraint. You find ways to improve the task of inspection (possibly hiring an additional inspector, improving the inspection equipment, and/or anything else that will speed up the task of inspection) and eliminate inspection as the constraint. Again, if inspection is this department's true current constraint, any improvement you make will have a direct impact on the company's total output.

After eliminating this current constraint, throughput time per workpiece in grinding department drops from four minutes, forty-five seconds to three minutes, fifty seconds. Now, grinding department is no longer the company-wide constraint. Instead, mill department (with a throughput time per workpiece of four minutes, fifteen seconds) becomes the current company-wide constraint. Any more improvements done in grinding department will have no impact on the company's current total output.

Of course, the next goal will be to eliminate the mill department as the current company-wide constraint. When this is done, the grinding department will again become the constraint. This leap-frog between grinder department and mill department will continue until the lathe department eventually becomes the current company-wide constraint.

More on spotting the current constraint

Admittedly, we've kept our example pretty simple. In reality, you may find it more difficult to locate the current constraint. And it may get progressively more difficult to do so as you continue with your constraint-elimination program. Additionally, factors beyond your control will affect which entity is the current constraint. Unfortunately some of these factors may even change on a very regular basis. These factors include business climate, which of your company's products is currently selling the best, and even something as basic as variations in the skill level of the people involved (if your company experiences a great deal of employee turnover). The more diverse your company, the more "transient" will be your company's current constraint.

Before you begin working on any improvement, ask yourself "Will this improvement have an impact on the company's total output?" If it will not, you haven't truly found the current company-wide constraint.

What about manufacturing cells?

The previous example (mill department, lathe department, grinder department) described finding and eliminating the constraint on a company-wide and department-wide basis. Note that the same principles apply nicely to manufacturing cells, since most manufacturing cells are very much like mini-companies within a company. The primary goal with any manufacturing cell is to produce a completed workpiece or assembly in as short a period of time as possible. In essence, the company is minimizing throughput time for an entire workpiece or assembly.

A manufacturing cell can include any number of different machine tools and other manufacturing equipment. From our previous example, the cell could include a CNC turning center, a CNC machining center, and a cylindrical grinder. If this cell is the current company-wide constraint, improving output from this cell will in turn, improve the company's total output.

Use the same methods discussed earlier to locate and eliminate the current cell-wide constraint. Possibly the cylindrical grinder has the longest cycle time in the cell, making it the current cell-wide constraint. When you find ways to minimize this machine's cycle time, you improve the cell's total output (as well as the company's total output). If you get this machine's cycle time down below the cycle time for the CNC machining center, the machining center becomes the cell's current constraint. Find ways to eliminate it as the constraint. Continue this process until the manufacturing cell is no longer the current company-wide constraint.

What about stand-alone CNC machines?

If you have determined that a given CNC machine is the current department-wide constraint in a department that is the current company-wide constraint, any improvements you make on this machine will have a direct impact on the company's total output. Frankly speaking, this is the area with which our training materials for setup reduction and cycle time reduction will really help. We focus all of our efforts on helping you improve a given stand-alone CNC machine tool's productivity – maximizing its utilization.

But as stated earlier, this may be but a small part of your company's constraint elimination program. Unless your company is made up soley of CNC equipment, you must be prepared to improve the performance other types of manufacturing equipment. While many of the principles we offer will nicely apply, we limit our presentations of specific techniques to CNC machining centers and turning centers.

By a "stand-alone CNC machine", we mean a CNC machine that is not part of a manufacturing cell. Generally speaking, one operator will be running one CNC machine tool (though there are many companies that have one operator running two or more CNC machines).

Since the entire task of setup is non-productive (with almost all CNC machines, no workpieces can be run during setup), setup time adds to the machine's constraining effect. Anything you do to reduce setup time will have a direct impact on the machine's productivity, and will contribute to eliminating this machine as the constraint.

During a production run, the current constraint with a stand-alone CNC machine usually falls into one of two categories. One is "button-to-button time". Button-to-button time is the time that passes from a given event in one cycle to the same event in the next cycle. Since most people use the pressing of the cycle start button as the event, we call it button-to-button time. Notice that button-to button time does include the tasks of workpiece loading and unloading.

The other potential constraint during a production run is related to tasks you expect the CNC operator to perform in conjunction with the CNC cycle. Many companies, for example, expect CNC operators to clean and de-burr workpieces coming from the CNC machine, inspect them, and report measurements to the company's statistical process control (SPC) system during every CNC cycle. This is, of course, in addition to the CNC operator's normal responsibilities related to preparing raw material for workpiece loading, sizing (offset) adjustments required due to tool wear, and tool replacement when tools get dull. If a CNC

operator cannot keep up a CNC machine tool for any reason, the constraint will not be the CNC machine tool - it will be the CNC operator.

From a bottom-line standpoint, CNC machine time is more valuable than the operator's time. Consider, for example, that the shop rate for a CNC machine is commonly at least four times the hourly wage of its operator. If your CNC operator cannot keep up with the CNC machine, be sure the operations he or she performs is worth the lost machine time!

Why work on improvements that are not related to the current constraint?

We've mentioned several times that improving in an area that is not the current constraint may have certain benefits, but will not improve the company's total output. Again, we've been assuming that the highest emphasis is being placed on improving the company's total output – which is a very important goal.

There will be times, however, when working on an entity that is not the current constraint will be beneficial, even though it does not increase the company's total output.

Other goals that require you to improve include:

- Scrap reduction
- Lowering production costs
- Minimizing tooling costs
- Getting more output from current (or fewer) resources
- Increasing skill levels (training)
- Anything that will save your company money

Again, you may not be improving the company's total output, but you are enhancing its ability to make a profit.

In addition, every area of your company will eventually become the current constraint (if you work on constraint elimination long enough). Working on an entity that will soon become the current constraint will keep it from becoming the constraint. This is especially important when you anticipate a change in the way the company operates. Possibly you know that a new product will create an increased demand on a department within the company. In essence, you can be gearing up for the increased demand.

A note about justification

Companies go to great lengths to come up with justification methods. One popular method utilizes a thirty percent rule-of-thumb. A company should be able to invest thirty percent of an expected savings to implement an improvement. If you come up with an improvement that will save $100.00, your company will probably be willing to spend $30.00. Most companies will limit the payback period. The shorter the period, the more difficult it will be to justify an improvement.

Since your company' very survival can be directly tied to its maximum total output, your justification methods may not apply to improvements made for the purpose of eliminating the current company-wide constraint. If you must improve output in order to compete and survive, you should be willing to spend what it takes to improve output, regardless of whether it is justifiable to do so using your company's justification methods.

Conclusion

You can apply a shotgun approach to making improvements and you will reap some benefits. But if you understand the principles of constraint elimination, you can use a logical method for setting priorities related to making improvements. And you can ensure that your improvement will have a dramatic impact on your company's success. Frankly speaking, if the primary goal of improving is to increase total output, you shouldn't be working on improving anything if it will not increase the company's total output!

M01

Product corner

Cycle time reduction CD rom course

Available April, 2002

When you think about it, there are only two activities with any CNC machine tool. Machines are either in setup - or they are running production. We define cycle time as the total length of time it takes to complete a production run divided by the number of good workpieces produced.

By this definition, anything you can do to reduce the time it takes to complete a production run will in turn reduce cycle time - and should be fair game for your cycle time reduction program.

In this CD rom course, we provide you with the materials you need to embark on your own cycle time reduction program.

We begin with some basic premises, helping you understand the magnitude of your CNC environment.

We then present principles of cycle time reduction, including the two task types, the three ways to reduce cycle time, and the four steps to cycle time reduction.

Finally, we offer specific suggestions for improving tasks related to completing production runs, including preparation and organization, workpiece loading, program execution, workpiece unloading, other tasks that occur during every cycle, sizing adjustments, tool replacement, and other tasks done during a production run.

Don't miss your chance to learn how to increase the output from your CNC machines!

Pricing:

Full course - CDR-CTR: $239.00
Courseware only - CDR-CTR-D: $189.00
Manual only - BP-CTR-M: $50.00

When purchased together with our Setup Reduction CD-rom Course, total will be $399.00 (a savings of $79.00)

CNC CONCEPTS, INC.
44 Little Cahill Road
Cary, IL 60013
Ph: (847) 639-8847
Fax: (847) 639-8857

The Optional Stop Newsletter Enclosed!

Mailroom: PAID SUBSCRIPTION ENCLOSED. Please assure delivery to addressee. Thank You!

Products That Address The Needs Of CNC Technology Today!

Use this handy form to request more information about our products.

CNC Video Courses:

- ❑ Machining Center Programming And Operation
- ❑ Turning Center Programming And Operation
- ❑ Conversational Turning Center Programming & Op
- ❑ Custom Macro Programming
- ❑ Four Axis Turning Center Programming

CD-rom Courses:

- ❑ Machining Center Programming, Setup, & Operation
- ❑ Turning Center Programming, Setup, & Operation
- ❑ Setup Reduction for CNC
- ❑ Cycle Time Reduction for CNC
- ❑ Parametric Programming
- ❑ CNC Router Programming, Setup, & Operation
- ❑ Advanced Techniques With Basic CNC Features

CNC Publications:

- ❑ Machining Center Self Study Course
- ❑ Turning Center Self Study Course
- ❑ CNC Router Self Study Course
- ❑ Managing CNC Operations
- ❑ CNC For Machining
- ❑ CNC Advanced Techniques
- ❑ CNC Accessory Devices
- ❑ The Optional Stop Subscription & Back Issues

CNC Mini-Vids:

- ❑ Related To Selected CNC Topics Like Setup Time Reduction, Cycle Time Reduction, Probing

CNC In-Plant Training:

- ❑ Basic CNC Courses
- ❑ CNC Tune-Up - For your *experienced* People

CNC Course Curriculums For Instructors:

- ❑ Machining Center Programming And Operation
- ❑ Turning Center Programming And Operation
- ❑ CNC Setup Reduction for CNC
- ❑ CNC Router Programming And Operation
- ❑ Maximizing CNC Utilization (NEW!)

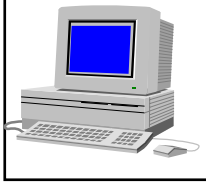
If other than above:

Name: _____

Company Name: _____

Address: _____

City, State, Zip: _____



Check Out Our Website!
http://www.cncci.com/
Information about each of our products is on line!