



# Impact to Cost Estimates When Upgrading to aPriori Professional 2019 R2

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## Document Information

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The latest version of this document can be found at the aPriori Support HelpCenter (requires registration): <https://support.apriori.com/hc>

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# aPriori

## About This Guide

This section provides general information about this Cost Impact document.

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Key topics include:

- Overview
  - Related documents
  - Typographic conventions
  - Feedback and customer support
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## Overview

This document provides an assessment of potential changes to Cost Estimates when you perform an upgrade to aPriori 2019 R2.

With each release, aPriori continues to improve and refine both our cost models and the overall costing framework. Although every measure is taken to guard against disruptions at customer sites during an upgrade, changes in Cost Estimates can occur. The exact impact will depend on your VPE and process groups you use. This document is intended to outline potential impact areas as a means to help prepare and plan for an upgrade.

This document does not pertain to new customers who are newly deploying aPriori 2019 R2 as there are no existing cost estimates to impact and change.

## Related documents

In addition to this guide, you can find more information about the aPriori application in the following documents:

- *aPriori User Guide* – This guide contains detailed information about the aPriori solution. It is designed as a reference for your everyday work.
- *aPriori System Administration Guide* – This guide contains detailed information about administering the aPriori solution using the System Admin toolset. It is designed to be used as a reference for aPriori system administrators.
- *aPriori VPE Administration Guide* – This guide contains detailed information about using the tools in the virtual production environment (VPE) toolset to maintain the VPEs in your aPriori deployment. It is designed as a reference for VPE administrators.
- *aPriori Cost Model Workbench User Guide* – This guide explains how to use aPriori's Cost Model Work Bench (CMWB) to customize cost models.
- *aPriori Release Notes* – This document highlights the changes made in aPriori since the previous release. It also contains last minute information about the release.
- *aPriori Installation Guide* – This guide contains detailed information about installing aPriori.
- *System Requirements* – This document provides information on the minimum and recommended client and server requirements to run aPriori, as well as the CAD file formats supported by aPriori.

# Typographic conventions

The following conventions are used in this guide to convey additional information.

Style	Description	Example
Code	Code style is used for text that is used literally, appearing exactly as shown. This includes command names, path and file names, and system information.	E:\setup.exe
<i>Italic code</i>	Italic code style is used for names of variables that you must provide. For example, you need to supply a value for <i>your_file</i> in the path name example to the right.	C:\aPriori\ <i>your_file</i>
<b>GUI</b>	GUI style is used to indicate objects in the aPriori interface.	the <b>Document</b> field
<b>GUI Action</b>	GUI Action style is used to indicate objects in the aPriori interface that you act on.	Click <b>OK</b> .

**Note** Notes highlight information, provide supplementary information, offer time-saving or easier ways to perform the same task, or explain how to prevent errors or data loss. Be sure to read this information carefully.

## Feedback and customer support

We appreciate your comments about this guide. Please contact us with your comments, questions, and requests for technical support.

Website: <http://www.apriori.com/support>

Email: [support@apriori.com](mailto:support@apriori.com)



# 1 Determining Your Impact Assessment

This section provides an overview of how changes in the product can influence cost, and how to assess these changes in your particular deployment(s).

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Key topics include:

- Product Factors that Influence Cost
  - Upgrade Impact Assessment Decision Flow
  - Planning and Assessing Your Upgrade
  - Impact Assessment by Process Group
-

## Product Factors that Influence Cost

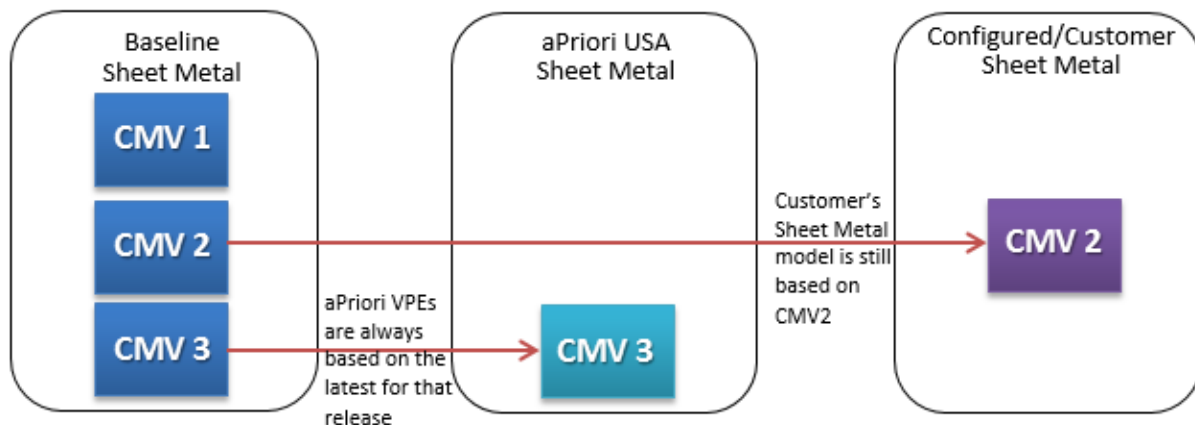
There are three main product factors that influence costs in the aPriori product. They are:

- **GCD Extraction:** Geometry that aPriori extracts from CAD parts that are inputs to costing
- **Cost Engine:** The engine that interprets the cost model intent and design to produce a cost
- **Cost Models:** The mathematical models that calculate cycle times and costs from both geometry and VPE inputs

When an assessment is made to whether a particular product change will impact cost, the above factors are considered. Both GCD Extraction and the Cost Engine are considered part of the aPriori Costing Platform and are common for all Cost Models and VPEs that are deployed on that aPriori release. These components are not versioned.

Cost Models are versioned by a Cost Model Version (CMV) number. Every aPriori Baseline or Configured VPE that has been built always declares a CMV and aPriori always maintains backwards compatibility with every CMV that has ever shipped. Versioning cost models allows aPriori to make improvements to newer cost models, while guarding against changing the behavior of previously-configured customer VPEs. Customers can leverage these improvements in upcoming upgrade activities on their own timeframe.

aPriori always upgrades the CMV of its Baseline VPEs when substantial improvements are made to a cost model and the Baselines always ship with the latest CMV being active. The following illustrates this concept using the Sheet Metal cost model as an example. In this example, a customer VPE was built against CMV2, but the latest shipping CMV for Sheet Metal is CMV3:



The above interplay is what drives the impact assessment to cost estimates when a customer upgrades to the next release.

- If changes to the aPriori Costing Platform have occurred, then regardless of CMV, these changes will impact upgrade. The extent of impact will depend on the change, but sometimes changes are additive; existing cost models would not fail since their logic doesn't account for this additive nature.
- If no changes in the aPriori Costing platform exist, then we need to review the changes in Cost Model Versioning and review where changes have occurred. If changes are localized to only the latest CMV, then there is no impact to upgrade for configured VPEs.



The next section outlines the decision flow for assessing impact to upgrade.

## Upgrade Impact Assessment Decision Flow

This section outlines the decision flow to determine if there is an impact to upgrade using the concepts outlined in the preceding section.

The Impact Assessment classification and terminology used here is consistent throughout the documentation and will refer to this decision flow when making an impact on upgrade. The next section describes how you will use this information in making an assessment.

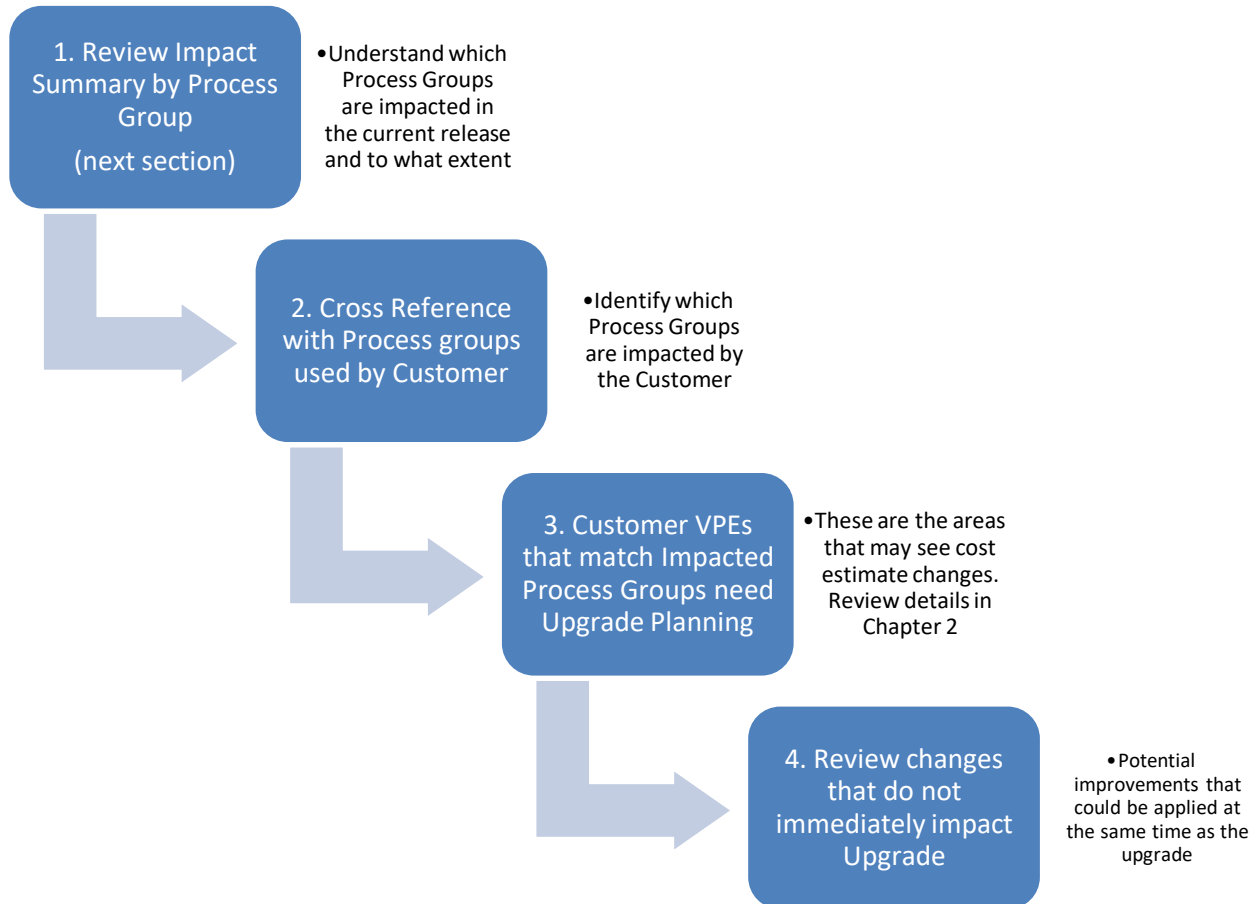
Impact Classification	Circumstances when this Impact will be marked YES	Upgrade Actions
Geometry or Cost Engine Changes that Likely Impact Customer VPEs	<p>This is marked YES under two main situations:</p> <p><b>(1) If the changes to aPriori's geometry are such that they redefine existing GCDs.</b> The impact is that a VPE's results may not be the same as before, since the inputs to the VPE may be different. If test results show unsatisfactory behavior, you have three options:</p> <ul style="list-style-type: none"> <li>a) Rev the cost model version to take advantage of new cost model</li> <li>b) Edit the existing cost model</li> <li>c) Execute a combination of both</li> </ul> <p>These changes would take advantage of new types of GCDs, new GCD properties, and so forth.</p> <p><b>(2) If the cost engine changes are such that they redefine how the cost engine interprets CSL and Cost Model intent.</b> This is a less frequent situation. If test results show unsatisfactory behavior, the cost model needs to be updated so that the cost engine can correctly interpret the logic as intended by the original design, and you have three options:</p> <ul style="list-style-type: none"> <li>a) Rev the cost model version to take advantage of new cost model</li> <li>b) Edit the existing cost model</li> <li>c) Execute a combination of both</li> </ul> <p>In these situations, the cost model needs to be rebuilt and/or recalibrated so that the VPE intent is maintained under the new geometry and cost engine schemes.</p>	<p><b>Testing required, potential config/calibration necessary.</b> Please contact aPriori Support with questions, or your aPriori Account Manager to plan work if you require assistance</p>
Bug Fixes or Small Improvements to Shipping CMV that Could	<p>This is marked YES under three main situations:</p> <p><b>(1) There are incremental improvements and updates to Geometry:</b> These changes simply introduce more cases that now work better and improve the default behavior.</p>	<p><b>Testing required, potential config/calibration necessary.</b> Please contact aPriori Support</p>

<p>Impact Customer VPEs</p>	<p><b>(2) The cost model was not increased in the shipping baseline cost model version:</b> If the customer VPE inherits any portion of the cost model from the Baselines against the same CMV, there will be cost changes. These are considered improvements to the previously shipped behavior.</p> <p><b>(3) The part uses the Baseline Machining model for Secondary Machining:</b> Since the machining model has changed in aP 2019 R2, customer parts may use the Baseline machining model for secondary machining if no secondary machining is available in the customer VPE and machining analysis is invoked by the cost engine.</p> <p>This information is being presented here primarily since many customer databases do have parts that are costed against the baseline VPEs and when those parts are re-costed in aP 2019 R2, one may see cost variations due to these changes.</p>	<p>with questions, or your aPiori Account Manager to plan work if you require assistance.</p>
<p>Changes to Baselines that do not affect Customer VPEs</p>	<p>This is marked YES if there are baseline VPE changes that will not impact customer VPEs. Typically, it involves changes done on a newer cost model version that is not available in the field. Changes in Geometry do not affect this functionality.</p>	<p>If you want to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent CMV. Please contact your VPE Admin or aPiori Account Manager to plan work.</p>

**Note:** If items in the first two categories above are marked NO, then the Process Group will have No Impact to Upgrade. This will be noted on the summary and detailed assessments. Depending on the extent of changes in the first two categories, Process Groups will be classified as HIGH, MODERATE or LOW Impact to upgrade.

# Planning and Assessing Your Upgrade

The following outlines the process you will now follow in assessing your impact. We will use the concepts and terminology developed in the preceding sections. The Impact Summary by Process Group is shown in the next section.



## Notes:

- Once you have identified the process groups that may be affected at your deployment, see Chapter 2 Detailed Impact Assessment by Process Group for details on the specifics of changes.
- Step 4 above is optional. By default, when you upgrade to a newer version of aPriori, customer configured VPEs are NOT upgraded to a newer cost model version. To get access to any cost model enhancements made in a newer version, you must explicitly indicate you wish to move to the newer version. This step can be taken when upgrading to aPriori 2019 R2, or at some subsequent times.

# Impact Assessment by Process Group

The overall Impact Assessment is now summarized across two tables. The first table provides a big picture assessment as to relative impact and the second provides a detailed look by decision flow. Together, they form the impact assessment. Review Chapter 3 for details on the impact.

## Relative Impact by Process Group

This table provides a high-level comparison across all Process Groups in aPiori in terms of gauging which areas are impacted more than others.

Relative Impact To Upgrade	Process Groups	Comments/Remarks
High	<ul style="list-style-type: none"> <li>Bar &amp; Tube</li> <li>Plastic Molding</li> <li>Assembly Molding</li> <li>Casting – Die</li> <li>Sheet Metal – Transfer Die</li> <li>Sheet Metal</li> </ul>	These Process Groups underwent the most development this release and are expected to incur the most impact.
Moderate	<ul style="list-style-type: none"> <li>Secondary Machining</li> <li>Stock Machining</li> <li>2-Model Machining</li> <li>Sheet Metal – Stretch Forming</li> <li>Sheet Metal – Hydroforming</li> <li>Forging</li> <li>Powder Metal</li> <li>Rotational and Blow Molding</li> </ul>	<p>This Process Group may see some impact depending on specific part and VPE configurations, but the occurrence is less when compared with the High impact group.</p> <p>Note that 2-Model Machining on its own does not have a moderate impact, however, it is dependent on Secondary Machining which underwent a moderate amount of change (particularly for users of NX CAD models).</p>
Low	<ul style="list-style-type: none"> <li>Surface Treatment</li> <li>Assembly</li> <li>Sheet Plastic</li> <li>Other Secondary Processes</li> </ul>	These Process Groups include new processes that are never automatically included in a routing.
No Impact	<ul style="list-style-type: none"> <li>Additive Manufacturing</li> <li>Casting – Sand</li> <li>Heat Treatment</li> <li>Part Assembly</li> <li>User Guided</li> </ul>	These Process Groups have no changes to them that would impact cost estimates. But note that changes to the Machining process group can impact secondary machining for some of these groups.

## Decision Flow Assessment

Using the Decision Flow described earlier, the following is a summary, by Process Group, of the overall impact to upgrade given the changes in aPriori 2019 R2.

Process Group	Upgrade Impact Assessment			Cost Model Versions Supported in the Last 3 Releases, Latest shown first
	Geometry or Cost Engine Changes that Likely Impact Customer VPEs	Bug Fixes or Small Improvements to Shipping CMV that Could Impact Customer VPEs	Changes to Baselines that do not affect Customer VPEs	
<b>HIGH Impact to Upgrade</b>				
Bar & Tube	YES	NO	YES	130, 120/110, 110
Plastic Molding	NO	NO	YES	140, 130/120, 110
Assembly Molding	NO	NO	YES	20, 10/0, N/A
Casting - Die	NO	NO	YES	60, 50/40, 30
Sheet Metal – Transfer Die	NO	NO	YES	70, 60/50, 40
Sheet Metal	NO	NO	YES	170, 160/150, 150
<b>MODERATE Impact to Upgrade</b>				
Secondary Machining	YES	NO	YES	190, 180/170, 150/160
Stock Machining	YES	NO	YES	90, 80, 80
2-Model Machining	NO	NO	NO	50, 40, 40
Sheet Metal – Stretch Forming	NO	NO	YES	30, 20/10, 10
Sheet Metal - Hydroforming	NO	NO	YES	20, 10/0, 0
Forging	NO	NO	YES	110, 100/90, 90
Powder Metal	NO	NO	YES	60, 50, 50
Roto & Blow Molding	NO	NO	YES	80, 70, 60
<b>LOW Impact to Upgrade</b>				
Surface Treatment	NO	NO	YES	130, 120/110, 100
Assembly	NO	NO	YES	120, 110/100, 90
Sheet Plastic	NO	NO	YES	70, 60, 60
Other Secondary Processes	NO	NO	YES	100, 90, 80
<b>NO Impact to Upgrade</b>				
Additive Manufacturing	NO	NO	NO	50, 40/30, 20
Casting - Sand	NO	NO	NO	60, 50/40, 30
Heat Treatment	NO	NO	NO	80, 70, 60

*Impact to Cost Estimates*

Part Assembly	NO	NO	NO	60, 50, 50
User Guided	NO	NO	NO	20, 20, 20

# 2 Detailed Impact Assessment by Process Group

This section provides details about 2019 R2 changes that impact specific process groups. See also the *aPriori Professional Release Notes*.

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Key topics include:

- All Process Groups
- Bar & Tube (High Impact)
- Plastic Molding (High Impact)
- Assembly Molding (High Impact)
- Casting - Die (High Impact)
- Sheet Metal - Transfer Die (High Impact)
- Sheet Metal (High Impact)
- Machining (Moderate Impact)
- Stock Machining (Moderate Impact)
- 2 Model Machining (Moderate Impact)
- Sheet Metal – Stretch Forming (Moderate Impact)
- Sheet Metal – Hydroforming (Moderate Impact)
- Forging (Moderate Impact)
- Powder Metal (Moderate Impact)
- Rotational & Blow Molding (Moderate Impact)
- Surface Treatment (Low Impact)
- Assembly (Low Impact)
- Sheet Plastic (Low Impact)
- Other Secondary Processes (Low Impact)
- Additive Manufacturing (No Impact)
- Casting - Sand (No Impact)

- Heat Treatment (No Impact)
  - Part Assembly (No Impact)
  - User Guided (No Impact)
- 

## All Process Groups

The following changes impact all process groups:

- **VPE Data:** See the aPriori Regional Data Libraries *Release Notes* for information on changes to VPE data, including labor, overhead, and material rates.
- **Labor Rates:** In previous releases, the **Labor Rate** field for every machine had to be populated and managed individually. In this release, you can manage **Labor Rate** fields by using *wage grades*. You can assign the same wage grade to multiple machines, and then, as desired, change the labor rate associated with those machines *all at once* by changing the labor rate associated with the assigned wage grade. Working with wage grades involves working with the following types of tables:
  - **Wage Grade Associations:** each process group has one Wage Grade Associations table, which associates machines with wage grades. Starting point VPEs include predefined wage grade associations that vary across processes but are the same for all machines within a given process.
  - **Wage Grades:** each VPE has one Wage Grades table, which contains definitions of wage grades. Each wage grade is identified by a skill level and a process type. Each wage grade also has an associated labor rate, which you can change as needed. Starting point VPEs include some predefined wage grades.
  - **Skill Levels:** each VPE has one Skill Levels table, which contains definitions of skill levels. Each wage grade associates a skill level and a process type (such as Metals or Plastics) with a labor rate. Starting point VPEs include some predefined skill levels.

For more information, see the section Working with Wage Grades in the *VPE Administration Guide*.



# Bar & Tube (High Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	130	New with this release
aPriori 2019 R1	110 (19.1.0) / 120 (19.1.1)	Currently Shipping
aPriori 2018 R3	110	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	Yes
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	YES
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

Note this process group can be affected by changes to the Machining process group.

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **Complex Hole Punching:** In previous releases, punching was considered infeasible for holes lying on non-planar surfaces, such as holes punched through the walls of a round tube. In this release, punching is feasible for such holes, provided they have walls that are parallel to one another. As a result, punching is now assigned to some complex holes that were previously assigned a different operation (typically, Laser Cutting). Cutting times may increase or decrease slightly (by a few seconds per hole, depending on the size and shape of the hole), compared to previous releases.

Note: This change has been backported to aPriori Professional Release 19.1.1.

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Material Cost and Scrap Credit:** In previous releases, the cost model always assumed that material scrap (for example, trim scrap) and part scrap (material from scrapped parts) was *not* sold for credit. In this release, the same assumption is made by default in starting point VPEs, but VPE administrators can enable scrap credit by default with the cost model variables **enableScrapMaterialCredit** and **enableScrapPartCredit**. In addition, users can override the default on a per-part basis with the setup options **Enable Scrap Material Credit** and **Enable Scrap Part Credit**.

If material scrap credit and/or part scrap credit is enabled, utilization increases and material cost decreases. Part scrap credit includes credit for parts scrapped by this process as well as by downstream processes. The credit rate is specified as a percentage of the material rate by the material property **Scrap Cost Percent**.

- **Extruded Material Stock:** This release provides a new Extrusions cost model for estimating the cost of parts made from custom aluminum extrusion profiles. If you have licensed the Extrusions cost model, aPriori attempts to recognize parts that can be manufactured from custom, extruded stock with light-to-moderate material removal. See the *aPriori Professional Release Notes* for more information.

# Plastic Molding (High Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	140	New with this release
aPriori 2019 R1	120 (19.1.0) / 130 (19.1.1)	Currently Shipping
aPriori 2018 R3	110	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

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## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

**NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **New Material Properties:** This release introduces three new material properties:
  - **Density of Melt**
  - **Specific Heat of Melt**
  - **Thermal Conductivity of Melt**

During costing, these new fields are now used to compute material thermal diffusivity, which in turn is an input to cool time calculations. In previous releases, the cool time calculations used the material property **Thermal Diffusivity**, taken directly from the material table rather than computed.

For some materials, the computed value for thermal diffusivity differs somewhat from the material table field value used in previous releases. As a result, the calculated cool time for a part might change in this release, compared to previous releases. The direction and magnitude of the change varies across materials and parts. See **Updated Material Property Values**, below.

Note that, in this release, if the new properties are not populated for the current material, the cool time calculations use the material property **Thermal Diffusivity** (which is now hidden by default in material property displays).

- **Updated Material Property Values:** some property values for some materials have been updated to increase accuracy. Properties that have been updated for some materials include:
  - **Density**
  - **Eject Deflection Temp**
  - **Melting Temp**
  - **Mold Temp**
  - **Injection Pressure Max**
  - **Injection Pressure Min**

For a small number of materials (including, for example, Nylon 66 and ABS materials), significant cost changes might occur:

- Parts with ABS materials: We observed an increase in cool time of around 45%-95%. For thin parts (thickness  $\leq$  4mm), we observed an increase in cost of around 30%-55%. For thicker parts (thickness  $>$  4mm—often made with Structural Foam Molding), we observed an increase in cost of around 60%-95%.
- Parts with Nylon material: We observed a decrease in cool time of around 15%-80%. We observed a decrease in cost of around 0%-30%

- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the cost model estimates the number of parts that can be produced with a given tool before it wears to the point that it needs to be replaced. Based on that estimate, the cost model now determines the number of tools required to manufacture the specified production volume, and accounts for that number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the following processes:

- Injection Molding
- Reaction Injection Molding
- Structural Foam Molding

Tool-life estimation is based on part material, tool material, and tool coating type. For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

With default production volumes (5,500 parts annually for 5 years), hard tooling cost is not affected by this change, as only one tool is required. With production volumes that require multiple tools, hard tooling cost increases compared to previous releases.

- **Improved Estimation of Tool Coating and Tool Heat Treatment Costs:** this release includes improved data for tool material density, tool material unit cost, and tool coating unit cost. As a result, hard tooling cost has been observed to increase by an average of 5%-10%, compared to the previous release.
- **Action Material Costs:** This release more accurately accounts for tooling costs for Structural Foam Molding and Reaction Injection Molding. With these processes, tooling costs increase somewhat for parts that require slides, rib inserts, grill inserts, or lifters.
- **Mold Height:** In previous releases, tooling cost calculations incorrectly ignored the setup options **Cavity Plate Height** and **Core Plate Height**. In this release, the setup options correctly affect the determination of mold height and tooling cost. As a result, tooling costs may change compared to previous releases.

# Assembly Molding (High Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	20	New with this release
aPriori 2019 R1	10 (19.1.0) / 0 (19.1.1)	Currently Shipping
aPriori 2018 R3	N/A	N/A

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

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## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

**NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Thermal Diffusivity and New Material Properties:** This release introduces three new material properties:
  - **Density of Melt**
  - **Specific Heat of Melt**
  - **Thermal Conductivity of Melt**

During costing, these fields are now used to compute thermal diffusivity for the current material, which in turn is an input to cool time calculations. In previous releases, the cool time calculations used the material property **Thermal Diffusivity**, taken directly from the material table rather than computed.

For some materials, the computed value for thermal diffusivity differs somewhat from the material table field value used in previous releases. As a result, the calculated cool time for a part might change in this release, compared to previous releases. See **Updated Material Properties**, below.

Note that, in this release, if the new properties are not populated for the current material, the cool time calculations use the material property **Thermal Diffusivity** (which is now hidden by default in material property displays).

- **Updated Material Property Values:** some property values for some materials have been updated to increase accuracy. Properties that have been updated for some materials include:
  - **Density**
  - **Eject Deflection Temp**
  - **Melting Temp**
  - **Mold Temp**
  - **Injection Pressure Max**
  - **Injection Pressure Min**

For a small number of materials (including, for example, Nylon 66 and ABS materials), significant cost changes might occur:

- Parts with ABS materials: We observed an increase in cool time of around 45%-95%. For thin parts (thickness  $\leq$  4mm), we observed an increase in cost of around 30%-55%. For thicker parts (thickness  $>$  4mm—often made with Structural Foam Molding), we observed an increase in cost of around 60%-95%.
- Parts with Nylon material: We observed a decrease in cool time of around 15%-80%. We observed a decrease in cost of around 0%-30%

- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the cost model estimates the number of parts that can be produced with a given tool before it wears to the point that it needs to be replaced. Based on that estimate, the cost model now determines the number of tools required to manufacture the specified production volume, and accounts for that number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the process Insert Injection Molding. Tool-life estimation is based on part material, tool material, and tool coating type. For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

With default production volumes (5,500 parts annually for 5 years), hard tooling cost is not affected by this change, as only one tool is required. With production volumes that require multiple tools, hard tooling cost increases compared to previous releases.

- **Improved Estimation of Tool Coating and Tool Heat Treatment Costs:** this release includes improved data for tool material density, tool material unit cost, and tool coating unit cost. As a result, hard tooling cost has been observed to increase by an average of 5%-10%, compared to the previous release.
- **Mold Height:** In previous releases, tooling cost calculations incorrectly ignored the setup options **Cavity Plate Height** and **Core Plate Height**. In this release, the setup options correctly affect the determination of mold height and tooling cost. As a result, tooling costs may change compared to previous releases.



# Casting - Die (High Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	60	New with this release
aPriori 2019 R1	40 (19.1.0) / 50 (19.1.1)	Currently Shipping
aPriori 2018 R3	30	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

The Casting - Die process group may be impacted by changes in the Machining process group. Please review the impact assessment in the Secondary Machining process group.

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Refractory Coating:** for Gravity Die Casting routings, refractory coating and drying are now assumed to be applied to all cores by default in starting point VPEs. Compared to the previous release, this can result in increased costs and times, depending on the number and sizes of cores. For piece part cost, increases of around 1%-5% are typical; increases up to around 15% have been observed. You can manually exclude refractory coating from your routing, if desired.
- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the cost model estimates the number of parts that can be produced with a given tool before it wears to the point that it needs to be replaced. Based on that estimate, the cost model determines the number of tools required to manufacture the specified production volume, and accounts for that number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the following processes:

- Gravity Die Casting
- High Pressure Die Casting
- Trim

Tool-life estimation is based on part material, tool material, and tool coating type. For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

With default production volumes (5,500 parts annually for 5 years), hard tooling cost is not affected by this change, as only one tool is required. With production volumes that require multiple tools, hard tooling cost increases compared to previous releases.

- **Improved Estimation of Tool Coating and Heat Treatment Costs:** this release includes improved data for tool material density, tool material unit cost, and tool coating

unit cost. As a result, hard tooling cost has been observed to decrease by an average of 2%-3%, compared to the previous release.

The Casting - Die process group may be impacted by changes in the Machining process group. Please review the impact assessment in the Secondary Machining process group.

## Sheet Metal - Transfer Die (High Impact)

### Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	70	New with this release
aPriori 2019 R1	50 (19.1.0) / 60 (19.1.1)	Currently Shipping
aPriori 2018 R3	40	Currently Shipping

### Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

### Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO

Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Material Cost and Scrap Credit:** In previous releases, the cost model always assumed that material scrap (for example, trim scrap) and part scrap (material from scrapped parts) was not sold for credit. In this release, the same assumption is made by default in starting point VPEs, but VPE administrators can enable scrap credit by default with the cost model variables **enableScrapMaterialCredit** and **enableScrapPartCredit**. In addition, users can override the default on a per-part basis with the setup options **Enable Scrap Material Credit** and **Enable Scrap Part Credit**.

If material scrap credit and/or part scrap credit is enabled, utilization increases and material cost decreases. Part scrap credit includes credit for parts scrapped by this process as well as by downstream processes. The credit rate is specified as a percentage of the material rate by the material property **Scrap Cost Percent**.

- **Required Shear Force:** In previous releases, required shear force was always calculated on the assumption that cluster punching was *not* used (that is, on the assumption of a single shear plane, with all GCDs pressed at the same time). In this release, the same assumption is made by default in starting point VPEs, but VPE administrators can customize the default number of shear planes with the cost model variable **numShearPlanes**. In addition, users can override the default on a per-part basis with the setup option **Number of Shear Planes**.

Multiple shear planes indicate the use of cluster punching, with different groups of GCDs pressed in a staggered fashion, rather than simultaneously. Required press force decreases as the number of shear planes increases. A decrease in required press force can sometimes lower costs due to selection of a lower-overhead machine.

- **Press Cycle Time and New Machine Property Strokes Per Minute:** This release introduces the new machine property **Strokes Per Minute**. During costing, this new field is used to compute press cycle time. In previous releases, press cycle time was taken directly from the machine property **Press Cycle Time**.

For a few machines, the computed value for press cycle time differs somewhat from the machine property (**Press Cycle Time**) used in previous releases. As a result, cycle time for these machines might go up between 0 and 60% or down between 0 and 90%.

Note that, in this release, if **Strokes Per Minute** is not populated for the current machine, the cost model uses the machine property **Press Cycle Time** (which is now hidden by default in machine property displays).

- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the cost model estimates the number of parts that can be produced with a given tool before it wears to the point that it needs to be replaced. Based on that estimate, the cost model determines the number of tools required to manufacture the specified production volume, and accounts for that number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the following processes:

- Transfer Die
- Offline Blanking

Tool-life estimation is based on part material, tool material, and tool coating type. For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

With default production volumes (5,500 parts annually for 5 years), hard tooling cost is not affected by this change, as only one tool is required. With production volumes that require multiple tools, hard tooling cost increases compared to previous releases.

- **Improved Estimation of Tool Coating and Tool Heat Treatment Costs:** this release includes improved data for tool material density, tool material unit cost, and tool coating unit cost. As a result, hard tooling cost has been observed to increase by an average of 2%-3%, compared to the previous release.

# Sheet Metal (High Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	170	New with this release
aPriori 2019 R1	150 / 160	Currently Shipping
aPriori 2018 R3	150	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Material Cost and Scrap Credit:** In previous releases, the cost model always assumed that material scrap (for example, trim scrap) and part scrap (material from scrapped parts) was not sold for credit. In this release, the same assumption is made by default in starting point VPEs, but VPE administrators can enable scrap credit by default with the cost model variables **enableScrapMaterialCredit** and **enableScrapPartCredit**. In addition, users can override the default on a per-part basis with the setup options **Enable Scrap Material Credit** and **Enable Scrap Part Credit**.

If material scrap credit and/or part scrap credit is enabled, utilization increases and material cost decreases. Part scrap credit includes credit for parts scrapped by this process as well as by downstream processes. The credit rate is specified as a percentage of the material rate by the material property **Scrap Cost Percent**.

- **Required Shear Force:** In previous releases, required shear force was always calculated on the assumption that cluster punching was *not* used (that is, on the assumption of a single shear plane, with all GCDs pressed at the same time). In this release, the same assumption is made by default in starting point VPEs, but VPE administrators can customize the default number of shear planes with the cost model variable **numShearPlanes**. In addition, users can override the default on a per-part basis with the setup option **Number of Shear Planes**.

Multiple shear planes indicate the use of cluster punching, with different groups of GCDs pressed in a staggered fashion, rather than simultaneously. Required press force decreases as the number of shear planes increases. A decrease in required press force can sometimes lower costs due to selection of a lower-overhead machine.

- **Press Cycle Time and New Machine Property Strokes Per Minute:** This release introduces the new Progressive Die machine property **Strokes Per Minute**. During costing, this new field is used to compute press cycle time. In previous releases, press cycle time was taken directly from the machine property **Press Cycle Time**.

For a few Progressive Die machines, the computed value for press cycle time differs somewhat from the machine property (**Press Cycle Time**) used in previous releases. As a

result, cycle time for these machines might go up between 0 and 60% or down between 0 and 90%.

Note that, in this release, if **Strokes Per Minute** is not populated for the current machine, the cost model uses the machine property **Press Cycle Time** (which is now hidden by default in machine property displays).

- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the cost model estimates the number of parts that can be produced with a given tool before it wears to the point that it needs to be replaced. Based on that estimate, the cost model determines the number of tools required to manufacture the specified production volume, and accounts for that number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the following processes:

- Generic Press
- Progressive Die
- Std Press
- Tandem Press

Tool-life estimation is based on part material, tool material, and tool coating type. For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

With default production volumes (5,500 parts annually for 5 years), hard tooling cost is not affected by this change, as only one tool is required. With production volumes that require multiple tools, hard tooling cost increases compared to previous releases.

- **Improved Estimation of Tool Coating and Tool Heat Treatment Costs:** this release includes improved data for tool material density, tool material unit cost, and tool coating unit cost. This release also includes improved logic for the estimation of tool coating costs. As a result, hard tooling cost for Generic Press, Std Press, and Tandem Press has been observed to increase by an average of less than 1%, compared to the previous release.

This release also includes improved logic for the estimation of tool coating costs. As a result, hard tooling cost for Progressive Die has been observed to decrease by an average of about 15%, compared to the previous release.



# Machining (Moderate Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	190	New with this release
aPriori 2019 R1	170 (19.1.0) / 180 (19.1.1)	Currently Shipping
aPriori 2018 R3	150 (18.3.0.0) / 160 (18.3.0.1)	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	Yes
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	YES
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NX Symbolic Threads:** aPriori now recognizes NX Symbolic Threads. In previous releases, for NX models, aPriori only recognized and costed threads that were modeled using the NX Threaded Hole feature. In this release, when you open an NX model, aPriori sets the **Threaded** property to **true** for GCDs to which the NX Symbolic Threads feature is applied; aPriori now assigns thread-making operations to such GCDs as appropriate. As a result, costs for such GCDs may increase, compared to previous releases.

See also [Stock Machining \(Moderate Impact\)](#).

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **New External Broaching Operation:** This release introduces the operation External AxiGroove Broaching for linear broaching of a rotationally-symmetric pattern of features, such as the fir-tree or dovetail root joint features commonly found on turbine and compressor disks. In previous releases, Hobbing was typically assigned to such features. In this release, the new external broaching operation is assigned instead, provided that both the following hold:
  - The feature is undercut, rendering it infeasible for Hobbing (that is, the geometric property **radialUndercutVolumeRatio** is greater than 0).
  - The geometry can be generated by extruding the tooth/valley profile in a straight direction (that is, the geometric property **isStraighExtrude** is **true**).

Depending on feature geometry, this can sometimes increase or decrease costs, compared to the previous release.

# Stock Machining (Moderate Impact)

## Cost Model Version Summary

The impact on this process group is rated **Moderate** largely because results in this group depend heavily on Machining, whose impact is rated **Moderate**.

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	90	New with this release
aPriori 2019 R1	80	Currently Shipping
aPriori 2018 R3	80	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	Yes
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	YES
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NX Symbolic Threads:** aPriori now recognizes NX Symbolic Threads. In previous releases, for NX models, aPriori only recognized and costed threads that were modeled using the NX Threaded Hole feature. In this release, when you open an NX model, aPriori sets the **Threaded** property to **true** for GCDs to which the NX Symbolic Threads feature is applied; aPriori now assigns thread-making operations to such GCDs as appropriate. As a result, costs for such GCDs may increase, compared to previous releases.

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

The Stock Machining process group may be impacted by the changes in the Machining process group. Please review the impact assessment in the Secondary Machining process group.

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Material Cost and Scrap Credit:** In previous releases, the cost model always assumed that material scrap and part scrap (material from scrapped parts) was *not* sold for credit. In this release, the same assumption is made by default in starting point VPEs, but VPE administrators can enable scrap credit by default with the cost model variables **enableScrapMaterialCredit** and **enableScrapPartCredit**. In addition, users can override the default on a per-part basis with the setup options **Enable Scrap Material Credit** and **Enable Scrap Part Credit**.

If material scrap credit and/or part scrap credit is enabled, utilization increases and material cost decreases. Part scrap credit includes credit for parts scrapped by this process as well as by downstream processes. The credit rate is specified as a percentage of the material rate by the material property **Scrap Cost Percent**.

The Stock Machining process group may be impacted by the changes in the Machining process group. Please review the impact assessment in the Secondary Machining process group.

## 2 Model Machining (Moderate Impact)

### Cost Model Version Summary

The impact on this process group is rated **Moderate** only because results in this group depend heavily on Machining, whose impact is rated **Moderate**.

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	50	New with this release
aPriori 2019 R1	40	Currently Shipping
aPriori 2018 R3	40	Currently Shipping

### Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

### Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	NO

# Sheet Metal – Stretch Forming (Moderate Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	30	New with this release
aPriori 2019 R1	10 (19.1.0) / 20 (19.1.1)	Currently Shipping
aPriori 2018 R3	10	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Material Cost and Scrap Credit:** In previous releases, the cost model always assumed that material scrap (for example, trim scrap) and part scrap (material from scrapped parts) was *not* sold for credit. In this release, the same assumption is made by default in starting point VPEs, but VPE administrators can enable scrap credit by default with the cost model variables **enableScrapMaterialCredit** and **enableScrapPartCredit**. In addition, users can override the default on a per-part basis with the setup options **Enable Scrap Material Credit** and **Enable Scrap Part Credit**.

If material scrap credit and/or part scrap credit is enabled, utilization increases and material cost decreases. Part scrap credit includes credit for parts scrapped by this process as well as by downstream processes. The credit rate is specified as a percentage of the material rate by the material property **Scrap Cost Percent**.

- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations always assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the same assumption is made by default in starting point VPEs, but users can override the default and specify the number of tools with a setup option. The cost model accounts for the specified number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the following processes:

- Stretch Form Cycles
- Router
- Bench Operation

For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

- **Improved Estimation of Tool Coating and Tool Heat Treatment Costs:** this release includes improved data for tool material density, tool material unit cost, and tool coating

unit cost. As a result, hard tooling cost has been observed to increase by an average of 5%-10%, compared to the previous release.

## Sheet Metal – Hydroforming (Moderate Impact)

### Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	20	New with this release
aPriori 2019 R1	0 (19.1.0) / 10 (19.1.1)	Currently Shipping
aPriori 2018 R3	0	Currently Shipping

### Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

### Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
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Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Material Cost and Scrap Credit:** In previous releases, the cost model always assumed that material scrap (for example, trim scrap) and part scrap (material from scrapped parts) was *not* sold for credit. In this release, the same assumption is made by default in starting point VPEs, but VPE administrators can enable scrap credit by default with the cost model variables **enableScrapMaterialCredit** and **enableScrapPartCredit**. In addition, users can override the default on a per-part basis with the setup options **Enable Scrap Material Credit** and **Enable Scrap Part Credit**.

If material scrap credit and/or part scrap credit is enabled, utilization increases and material cost decreases. Part scrap credit includes credit for parts scrapped by this process as well as by downstream processes. The credit rate is specified as a percentage of the material rate by the material property **Scrap Cost Percent**.

- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the cost model estimates the number of parts that can be produced with a given tool before it wears to the point that it needs to be replaced. Based on that estimate, the cost model determines the number of tools required to manufacture the specified production volume, and accounts for that number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the following processes:

- Hydroform

- Offline Blanking

Tool-life estimation is based on part material, tool material, and tool coating type. For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

With default production volumes (5,500 parts annually for 5 years), hard tooling cost is not affected by this change, as only one tool is required. With production volumes that require multiple tools, hard tooling cost increases compared to previous releases.

- **Improved Estimation of Tool Coating and Heat Treatment Costs:** this release includes improved data for tool material density, tool material unit cost, and tool coating unit cost. As a result, hard tooling cost has been observed to increase an average of 5%-10%, compared to previous releases.

# Forging (Moderate Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	110	New with this release
aPriori 2019 R1	90 (19.1.0) / 100 (19.1.1)	Currently Shipping
aPriori 2018 R3	90	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

The Forging process group may be impacted by the changes in the Machining process group. Please review the impact assessment in the Secondary Machining process group.

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Material Cost and Scrap Credit:** In previous releases, the cost model always assumed that material scrap (for example, trim scrap) and part scrap (material from scrapped parts) was *not* sold for credit. In this release, the same assumption is made by default in starting point VPEs, but VPE administrators can enable scrap credit by default with the cost model variables **enableScrapMaterialCredit** and **enableScrapPartCredit**. In addition, users can override the default on a per-part basis with the setup options **Enable Scrap Material Credit** and **Enable Scrap Part Credit**.

If material scrap credit and/or part scrap credit is enabled, utilization increases and material cost decreases. Part scrap credit includes credit for parts scrapped by this process as well as by downstream processes. The credit rate is specified as a percentage of the material rate by the material property **Scrap Cost Percent**.

- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the cost model estimates the number of parts that can be produced with a given tool before it wears to the point that it needs to be replaced. Based on that estimate, the cost model determines the number of tools required to manufacture the specified production volume, and accounts for that number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the following processes:

- Hammer
- Press
- Trim

Tool-life estimation is based on part material, tool material, and tool coating type. For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

With default production volumes (5,500 parts annually for 5 years), hard tooling cost has been observed to increase by an average of around 190%, as three tools are typically required (when no tool coating is applied—the default assumption).

## Powder Metal (Moderate Impact)

### Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	60	Currently Shipping
aPriori 2019 R1	50	Currently Shipping
aPriori 2018 R3	50	Currently Shipping

### Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

### Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO

Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

The Powder Metal process group may be impacted by the changes in the Machining process group. Please review the impact assessment in the Secondary Machining process group.

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the cost model estimates the number of parts that can be produced with a given tool before it wears to the point that it needs to be replaced. Based on that estimate, the cost model determines the number of tools required to manufacture the specified production volume, and accounts for that number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the process Compaction Pressing. Tool-life estimation is based on part material, tool material, and tool coating type. For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

With default production volumes (5,500 parts annually for 5 years), hard tooling cost is not affected by this change, as only one tool is required. With production volumes that require multiple tools, hard tooling cost increases compared to previous releases.

- **Improved Estimation of Tool Machining and Tool Material Costs:** this release includes improved data for tool material costs as well as improved estimation of tool machining costs. As a result, hard tooling cost has been observed to increase an average of about 20%, compared to the previous release. Fully burdened cost has been observed to increase an average of about 1%.

# Rotational & Blow Molding (Moderate Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	80	Currently Shipping
aPriori 2019 R1	70	Currently Shipping
aPriori 2018 R3	60	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **New Material Properties:** This release introduces three new material properties:
  - **Density of Melt**
  - **Specific Heat of Melt**
  - **Thermal Conductivity of Melt**

During costing, these new fields are now used to compute material thermal diffusivity, which in turn is an input to cool time calculations for Extrusion Blow Mold. In previous releases, the cool time calculations used the material property **Thermal Diffusivity**, taken directly from the material table rather than computed.

For some materials, the computed value for thermal diffusivity differs somewhat from the material table field value used in previous releases. As a result, the calculated cool time for a part might change in this release, compared to previous releases. The direction and magnitude of the change varies across materials and parts. See **Updated Material Property Values**, below.

Note that, in this release, if the new properties are not populated for the current material, the cool time calculations use the material property **Thermal Diffusivity** (which is now hidden by default in material property displays).

- **Updated Material Property Values:** some property values for some materials have been updated to increase accuracy. Properties that have been updated for some materials include:
  - **Density**
  - **Eject Deflection Temp**
  - **Melting Temp**
  - **Mold Temp**
  - **Injection Pressure Max**
  - **Injection Pressure Min**



For materials suitable for blow molding, non-negligible cost changes might occur. For a 1.5mm-thick part and a production volume of 50,000, we observed cost increases of 0%-10% for some materials and decreases of 0%-5% for other materials. For blow molding ABS materials, the cost increase was around 20%, compared to the previous release.

- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the cost model estimates the number of parts that can be produced with a given tool before it wears to the point that it needs to be replaced. Based on that estimate, the cost model determines the number of tools required to manufacture the specified production volume, and accounts for that number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the following processes:

- Extrusion Blow Mold
- Rotational Mold

Tool-life estimation is based on part material, tool material, and tool coating type. For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

With default production volumes (5,500 parts annually for 5 years), hard tooling cost is not affected by this change, as only one tool is required. With production volumes that require multiple tools, hard tooling cost increases compared to previous releases.

- **Improved Estimation of Tool Coating and Tool Heat Treatment Costs:** this release includes improved data for tool material density, tool material unit cost, and tool coating unit cost. Change to hard tooling cost is expected to be negligible.

## Surface Treatment (Low Impact)

### Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	130	Modified for this release
aPriori 2019 R1	110 (19.1.0) / 120 (19.1.1)	Currently Shipping
aPriori 2018 R3	100	Currently Shipping

### Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

### Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

### Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

### Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Manual Paint:** this release introduces the new Surface Treatment process Manual Paint, which is included automatically when you cost Composite parts. It is also available

for manual inclusion in other routings. The cost model accounts for the cost of sanding, cleaning, priming, painting, and curing the part in a paint-booth facility. The baseline cost model assumes the use of aerospace-grade primers and paints.

# Assembly (Low Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	120	Currently Shipping
aPriori 2019 R1	100 (19.1.0) / 110 (19.1.1)	Currently Shipping
aPriori 2018 R3	90	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- In previous releases, aPriori estimated pick-and-place assembling costs for uninitialized (that is, not-yet-costed) assembly components, as well as for manually-costed assembly components (those costed in the Manually Costed process group). This estimate was based on an estimate of the component's mass that assumed the material density of a common steel material. The estimated mass was displayed in the **Finish Mass** field of the Assembly Details tab

In this release, assembly pick and place costs are no longer estimated for such components. Un-costed and manually-costed components display a value of 0 in the **Finish Mass** field of the Assembly Details tab. Values are computed and displayed for **Finish Mass** and pick-and-place costs only if either the component has been costed or a **Finish Mass** value was specified for the component by using the BOM Loader capability.

# Sheet Plastic (Low Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	70	Currently Shipping
aPriori 2019 R1	60	Currently Shipping
aPriori 2018 R3	60	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

## Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

## Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Material Cost and Scrap Credit:** In previous releases, the cost model always assumed that material scrap (for example, trim scrap) and part scrap (material from scrapped parts) was *not* sold for credit. In this release, the same assumption is made by default in starting point VPEs, but VPE administrators can enable scrap credit by default with the cost model variables **enableScrapMaterialCredit** and **enableScrapPartCredit**. In addition, users can override the default on a per-part basis with the setup options **Enable Scrap Material Credit** and **Enable Scrap Part Credit**.

If material scrap credit and/or part scrap credit is enabled, utilization increases and material cost decreases. Part scrap credit includes credit for parts scrapped by this process as well as by downstream processes. The credit rate is specified as a percentage of the material rate by the material property **Scrap Cost Percent**.

- **Tooling Cost and Tool Life:** In previous releases, tooling cost calculations assumed that a single tool lasts long enough to produce the production volume specified in any scenario. In this release, the cost model estimates the number of parts that can be produced with a given tool before it wears to the point that it needs to be replaced. Based on that estimate, the cost model determines the number of tools required to manufacture the specified production volume, and accounts for that number of tools in total hard tooling cost.

Tool life is accounted for in the tooling cost calculations for the following processes:

- 2 Cavities Drape Forming
- 2 Cavities Vacuum Forming
- 4 Cavities Drape Forming
- 4 Cavities Vacuum Forming
- Single Cavity Drape Forming
- Single Cavity Vacuum Forming

Tool-life estimation is based on part material, tool material, and tool coating type. For a given costing, either the formula Dependencies or Investment tab displays the number of tools assumed by tooling cost calculations.

With default production volumes (5,500 parts annually for 5 years), hard tooling cost is not affected by this change, as only one tool is required. With production volumes that require multiple tools, hard tooling cost increases compared to previous releases.

- **Improved Estimation of Tool Coating and Tool Heat Treatment Costs:** this release includes improved data for tool material density, tool material unit cost, and tool coating unit cost. Change in hard tooling cost is expected to be negligible.

## Other Secondary Processes (Low Impact)

### Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	100	New with this release
aPriori 2019 R1	90	Currently Shipping
aPriori 2018 R3	80	Currently Shipping

### Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

### Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.



Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	YES

### Details: Geometry or Cost Engine changes that likely impact Customer VPEs

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

### Details: Bug Fixes or Small Improvements to Shipping Cost Model Versions

The following changes may necessitate potential configuration and calibration activities - VPE testing is required. Please contact your aPriori Account Manager to plan work if you require assistance.

- **NO IMPACT**

### Details: Changes to Baselines that DO NOT affect Customer VPEs

The following changes are available in the aPriori Baseline VPEs only. If you wish to take advantage of these new capabilities, the VPE needs to be upgraded to the most recent Cost Model version. Please contact your VPE Admin or aPriori Account Manager to plan work.

- **Ultrasonic Scan:** this release introduces two new nondestructive inspection processes for detection of defects within materials:
  - Ultrasonic C-Scan: uses a probe and waterjet. This is included by default for Composites routings.
  - Ultrasonic A-Scan: uses a probe on a part that is submerged in a bath tank. Must be included manually.

# Additive Manufacturing (No Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	50	New with this release
aPriori 2019 R1	30 (19.1.0) / (19.1.1) 40	Currently Shipping
aPriori 2018 R3	20	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	NO

# Casting - Sand (No Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	60	New with this release
aPriori 2019 R1	40 (19.1.0) / 50 (19.1.1)	Currently Shipping
aPriori 2018 R3	30	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	NO

The Casting--Sand process group may be impacted by changes in the Machining process group. Please review the impact assessment in the Secondary Machining process group.

# Heat Treatment (No Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	80	Currently Shipping
aPriori 2019 R1	70	Currently Shipping
aPriori 2018 R3	60	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	NO

# Part Assembly (No Impact)

## Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	60	Currently Shipping
aPriori 2019 R1	50	Currently Shipping
aPriori 2018 R3	50	Currently Shipping

## Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

## Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	NO

## User Guided (No Impact)

### Cost Model Version Summary

This is a summary of the cost model version changes for the last three releases. It shows the newly introduced cost model version, if any, for this release as well as the last two shipping versions. This information is used in conjunction with the upgrade assessment discussed in the next sections.

Release	Cost Model Version	Status
aPriori 2019 R2	20	Currently Shipping
aPriori 2019 R1	20	Currently Shipping
aPriori 2018 R3	20	Currently Shipping

### Summary of Platform Changes

The following summarizes whether there were aPriori Platform changes for this process group. Changes in the Platform could impact costing results for Customer VPEs regardless of cost model version. The combination of this information and cost model version summary forms the basis of the upgrade assessment discussed next.

Platform Area	Was there a Change?
Geometry	No
Cost Engine	No

### Deployment & Upgrade Assessment Summary

This section provides an assessment whether there is an impact to Deployment and Upgrade for this process group.

If either of the first two sections below is marked YES, then the customer must review the technical details on the next section to understand what changes will impact costs and whether a recalibration is necessary. The third section highlights changes to the aPriori Baseline Cost Model for the **newly introduced cost model version** (see first table above) that customers may take advantage of during an upgrade of their VPEs. Please review the next section for more details.

Area	Impact?
Geometry or Cost Engine changes that likely impact Customer VPEs	NO
Bug fixes or small improvements to Shipping Cost Model versions that <b>could</b> impact Customer VPEs	NO
Changes to aPriori Baselines that <b>do not</b> affect Customer VPEs	NO



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