

## Strand7 R24 to R3 API Conversion Guide

### Introduction

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This document is a guide for converting a Strand7 R2.4 API (R24) program to run with the Strand7 R3.1.4 API (R3).

### Compatibility

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The R3 API is a 64-bit Windows DLL that can only be called from 64-bit applications. It is not possible for a 32-bit program to call functions inside a 64-bit DLL. To link to the R3 API it is necessary to compile for "64-bit" or the "x64 platform". Developers using Excel VBA, Python or MATLAB must use 64-bit versions.

The R3 API is not 100% backward compatible with previous API releases. Since all program code must be recompiled for 64-bit, the decision was made to take this opportunity to update the API interface to better reflect the R3 workflow and feature set.

### Model Window

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The R3 API provides three different modes of operation for refreshing the model window; the mode is set via the function `St7SetModelWindowRefresh`.

In auto-refresh mode (`wrAutoRefresh`), the model window remains synchronised with the model, automatically refreshing as changes are made. For example, if new elements are inserted, the model window will refresh automatically as each element is added.

In pause-clear (`wrPauseClear`) and pause-no-clear (`wrPauseNoClear`) modes, the model window remains responsive until a user action or API call invalidates it. While the model window is valid it can respond to view changes and/or window resizes. Once the model window is invalidated, the window is not updated until either `St7RedrawModel` is called (which performs a one-off synchronisation), or the mode is changed to auto-refresh mode (which performs and maintains synchronisation).

The difference between `wrPauseClear` and `wrPauseNoClear` modes is in what is displayed in an invalidated model window. An invalidated model window will be cleared with `wrPauseClear`, whereas it will continue to display the previous graphics with `wrPauseNoClear`, even if the previous graphics are out of date with the current state of the model. The advantage of `wrPauseNoClear` is that it avoids a screen flicker that can occur when the window is cleared between pausing it and refreshing it after the model has changed. Both modes will disable interaction with the model window (such as the Entity Inspector and selecting).

API calls will take longer to perform with the `wrAutoRefresh` mode since more work is required to continually update the model window in response to model changes.

Frequent updates to the status bar can also impact program performance. To address this, the function `St7SetStatusBarUpdateMode` is provided, which allows updates to the status bar to be suspended and resumed.

### Tools

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All of the tools in Strand7, accessible from the **VISUAL/Tools** tab, are available in the R3 API. In the R24 API, only a few of those tool functions are available.

The API tool functions work similarly to how they work in the Strand7 graphical user interface. The API workflow is as follows:

1. The entities that are to be operated upon by the tool function are selected using the entity selection functions (e.g., `St7SetEntitySelectState`).
2. State variables corresponding to the dialog options relevant to the tool function are set and updated by calling the relevant functions (e.g., `St7SetKeepSelect` for the **Keep selected** dialog option).
3. The tool function is called to do the work.

Using state variables for dialog options common to multiple tools means that the options do not need to be specified every time a tool is called. The functions to set state variables only need to be called when the state needs to be initialised or changed. The API manual documents the state variables that apply to each tool function.

Tools, when executed in Strand7, show a message on completion giving the number of entities affected by the operation. In the API, this information is stored in a global array whose values can be obtained by calling the function `St7GetGlobalIntegerValue` with a global integer index. For example, requesting index value `ivBeamsDeleted` will return the number of beams deleted by the tool.

## Markers

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The R3 API introduces a new set of functions that can be used for basic annotation of entities within the model window (`St7SetMarker`, `St7ShowMarker` and `St7HideMarker`, amongst others). See the API manual for more information.

## R3 DLL Solver

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The R3 API introduces a DLL version of the solver (in addition to the EXE version). The DLL version is advantageous for API projects that need to run the solver hundreds or thousands of times on relatively small models (e.g., optimisation applications). Once loaded, the DLL remains memory resident, so the time to launch the next solve is usually measurably less compared with loading the EXE version of the solver each time. See `St7SetUseSolverDLL` in the API manual.

## Results Contour File

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A new set of functions, including `St7GeneratePlateContourFile`, `St7LoadPlateContourFile` and `St7GetPlateContourFileResult`, provide a more efficient way to extract plate and brick element results when nodal averaged results are required over all, or most, of the elements in the model. Using contour files, the results are pre-calculated and stored for faster retrieval. See the API manual for more information.

## Steps for converting an R24 API program to run with the R3 API

### Step 1: Change to 64-bit target.

Your compiler needs to produce a 64-bit target to use the R3 API.

### Step 2: Replace the header files.

To use the R3 API functions, the R24 API header files contained in your project need to be replaced with the R3 header files. This will change the function signatures.

### Step 3: Consult Appendix 1 and replace functions.

Appendix 1 contains the list of R24 functions that are not available in R3 and suggests their replacement. The R3 API Manual provides information about the new functions.

### Step 4: Consult Appendix 2 and replace constants.

Appendix 2 contains the list of R24 constants that are not available in R3 and suggests their replacement. The R3 API Manual will provide more information about each of the constants.

### Step 5: Use the compiler to find functions with parameter changes.

After replacing function calls and constants, an attempt can be made to compile the program. The compiler will report errors for R24 functions whose parameters have changed in R3. For each compiler error, consult Appendix 3, which provides information about the changes. Refer to the R3 API manual for more information.

#### Messages

##### Checking project dependencies...

```
[dcc64 Error] st_SCL.pas(209): E2010 Incompatible types: 'Integer' and 'Boolean'
[dcc64 Error] st_SCL.pas(287): E2010 Incompatible types: 'Integer' and 'Boolean'
[dcc64 Error] st_SCL.pas(337): E2003 Undeclared identifier: 'UCSCartesian'
[dcc64 Error] st_SCL.pas(360): E2010 Incompatible types: 'Integer' and 'Boolean'
[dcc64 Error] st_SCL.pas(424): E2003 Undeclared identifier: 'kPlateTypeAxisymmetric'
[dcc64 Error] st_SCL.pas(544): E2010 Incompatible types: 'Integer' and 'Boolean'
[dcc64 Error] st_SCL.pas(1202): E2033 Types of actual and formal var parameters must be identical
[dcc64 Error] st_SCL.pas(1273): E2003 Undeclared identifier: 'kPlateTypeAxisymmetric'
[dcc64 Error] st_SCL.pas(2276): E2003 Undeclared identifier: 'St7APIVersion'
[dcc64 Error] st_SCL.pas(2277): E2035 Not enough actual parameters
```

##### Failed

Elapsed time: 00:00:00.6

For example, the first error (on line 209) is due to an incompatible type error, whereby an integer is expected but a boolean is passed. Looking at the function call in the code we have:

```
St7OpenResultFile(Id, FileName, '', true, NumPrimary, NumSecondary)
```

We see that the R24 signature for St7OpenResultsFile is as follows:

```
St7OpenResultFile(long uID, char* FileName, char* SpectralName, bool Combinations,
long* NumPrimary, long* NumSecondary)
```

By consulting Appendix 3, we can see that there is a change to the Combinations/CombinationCode argument.

The R3 signature from the API manual confirms this:

```
St7OpenResultFile(long uID, char* FileName, char* SpectralName, long CombinationCode,
long* NumPrimary, long* NumSecondary)
```

From the R3 API manual, the new constants to provide as input for the CombinationCode argument are:

- kNoCombinations – no combinations.
- kGenerateNewCombinations – generate new combinations.
- kUseExistingCombinations – open previously saved combinations if a valid .LSC file exists, otherwise,

generate the combinations.

Each compilation error can be addressed in this way until a clean compile is successfully obtained.

**Step 6: Consult Appendix 4 and modify parameters.**

Up to this point, it is relatively easy to make the appropriate conversions, and with this we have a compiled program. The next important step is to edit the functions whose argument list types have not changed, but where the meaning of one or more of the arguments has changed. The way to do this is to consult Appendix 4 to check whether your program uses any of the functions listed. For each function, take note of the change description, consult the R3 API manual, and modify your code.

**Step 7: Consult Appendix 5 and update constants.**

This step is only required if your code contains hard-coded constants (i.e., numeric literals) instead of using the named constants provided in the API header files. It is good programming practice to use named constants instead of hard-coded literals. If your code uses hard-coded literals, the task of replacing these with the correct named constants is likely to be a laborious one.

## Appendix 1 – R24 functions not available in R3

The table below lists R24 API functions that are not available in the R3 API. Where applicable, alternative functions are provided, or an explanation for their removal is given. Where an alternative function is not given, it means that the R24 function has no purpose in R3. For example, St7DisableSeismicNSMassCase is no longer relevant because seismic load cases in R3 all have their own non-structural mass attributes.

| R24 Function                       | R3 Function to Use/Comment   |
|------------------------------------|--|
| St7AddSRADirectionVector           | St7AddSRABaseCase  |
| St7APIVersion                      | St7Version, St7BuildString   |
| St7DeleteInvalidGeometryFaces      | St7DeleteInvalidGeometry   |
| St7DeleteSeismicCase               | St7DeleteLoadCase  |
| St7DeleteSRADirectionVector        | St7DeleteSRABaseCase   |
| St7DisableAutoAssignPathDivisions  | St7SetMovingLoadAutoDivisions  |
| St7DisableLSAInitialPCGFile        | St7DisableInitialPCGFile   |
| St7DisableNFANonStructuralMassCase | St7DisableNSMassCaseInMassMatrix   |
| St7DisableSeismicNSMassCase        | * Seismic cases in R3 define their own non-structural mass attributes.                         |
| St7EnableAutoAssignPathDivisions   | St7SetMovingLoadAutoDivisions  |
| St7EnableLSAInitialPCGFile         | St7EnableInitialPCGFile  |
| St7EnableNFANonStructuralMassCase  | St7EnableNSMassCaseInMassMatrix  |
| St7EnableSeismicNSMassCase         | * Seismic cases in R3 define their own non-structural mass attributes.                         |
| St7ExportANSYSFile                 | St7ExportANSYS   |
| St7ExportDXFFile                   | St7ExportDXF   |
| St7ExportIGESFile                  | St7ExportIGES  |
| St7ExportImageFile                 | St7ExportImage   |
| St7ExportNASTRANFile               | St7ExportNASTRAN   |
| St7ExportST7File                   | St7ExportST7   |
| St7ExportSTEPFile                  | St7ExportSTEP  |
| St7GetBeamAxisSystem               | St7GetBeamAxisSystemInitial, St7GetBeamAxisSystemBirth, St7GetBeamAxisSystemGNL                |
| St7GetBeamCFG4ID                   | St7GetBeamPointForceGlobal4ID  |
| St7GetBeamCFL4ID                   | St7GetBeamPointForcePrincipal4ID   |
| St7GetBeamCMG4ID                   | St7GetBeamPointMomentGlobal4ID   |
| St7GetBeamCML4ID                   | St7GetBeamPointMomentPrincipal4ID  |
| St7GetBeamDLG6ID                   | St7GetBeamDistributedForceGlobal6ID  |
| St7GetBeamDLL6ID                   | St7GetBeamDistributedForcePrincipal6ID   |
| St7GetBeamDML6ID                   | St7GetBeamDistributedMomentPrincipal6ID  |
| St7GetBeamSupport2F                | St7GetBeamSupport2   |
| St7GetBeamUseMomCurv               | St7GetBeamNonlinearMode  |
| St7GetBrickFaceAxisSystem          | St7GetBrickFaceAxisSystemInitial, St7GetBrickFaceAxisSystemBirth, St7GetBrickFaceAxisSystemGNL |
| St7GetBrickNSMass5                 | St7GetBrickNSMass5ID   |
| St7GetBrickPropertyData            | * See “Properties – Beams, Plates and Bricks” in API Manual.                                   |
| St7GetBrickResultUserEquation      | St7GetResultUserEquation   |
| St7GetBrickSupport1F               | St7GetBrickSupport4  |
| St7GetBuckFactor                   | St7GetBucklingFactor   |

| R24 Function                        | R3 Function to Use/Comment   |
|-------------------------------------|--|
| St7GetCleanGeometryData             | St7GetCleanGeometryOptions   |
| St7GetCleanMeshData                 | St7GetCleanMeshOptions   |
| St7GetEntityDisplay                 | * See "Entity Display" in API Manual.  |
| St7GetFrequencyTable                | St7GetFrequencyPeriodTableType   |
| St7GetGeometryEdgeAttachment1       | St7GetGeometryCoedgeAttachment1  |
| St7GetGeometryEdgeConvection2       | St7GetGeometryCoedgeConvection2  |
| St7GetGeometryEdgeConvectionTables  | St7GetGeometryCoedgeConvectionTables   |
| St7GetGeometryEdgeFlux1             | St7GetGeometryCoedgeFlux1  |
| St7GetGeometryEdgeFluxTables        | St7GetGeometryCoedgeFluxTables   |
| St7GetGeometryEdgeNormalShear1      | St7GetGeometryCoedgeTransverseShear1   |
| St7GetGeometryEdgePressure1         | St7GetGeometryCoedgePressure1  |
| St7GetGeometryEdgeRadiation2        | St7GetGeometryCoedgeRadiation2   |
| St7GetGeometryEdgeRadiationTables   | St7GetGeometryCoedgeRadiationTables  |
| St7GetGeometryEdgeRelease1          | St7GetGeometryCoedgeRelease1   |
| St7GetGeometryEdgeShear1            | St7GetGeometryCoedgeShear1   |
| St7GetGeometryEdgeSupport1F         | St7GetGeometryCoedgeSupport4   |
| St7GetGeometryFaceGlobalPressure3   | St7GetGeometryFaceGlobalPressure3S   |
| St7GetGeometryFaceNormalPressure1   | St7GetGeometryFaceNormalPressure2  |
| St7GetGeometryFaceNSMass5           | St7GetGeometryFaceNSMass5ID  |
| St7GetGeometryFaceSupport1F         | St7GetGeometryFaceSupport4   |
| St7GetHRAResultType                 | St7GetHRAMode  |
| St7GetLBAInitialFile                | St7GetLBAInitial   |
| St7GetLSACombinationSpectralName    | St7GetLSACombinationSRAName  |
| St7GetLSAInitialPCGFile             | St7GetInitialPCGFile   |
| St7GetLSAInitialPCGFileState        | St7GetInitialPCGFileState  |
| St7GetLTAInitialFile                | St7GetLTAInitial   |
| St7GetModalLoadType                 | St7GetHRALoadType, St7GetSRADirectionVectorType  |
| St7GetModalNodeReactionType         | * In R3, both inertia force and element force are available in the result file. See srNodeInertia in API Manual. |
| St7GetMultiPointLink                | St7GetInterpolatedMultiPointLink,<br>St7GetUserDefinedMultiPointLink   |
| St7GetNFAInitialFile                | St7GetNFAInitial   |
| St7GetNFANonStructuralMassCaseState | St7GetNSMassCaseInMassMatrixState  |
| St7GetNLAInitialFile                | St7GetNLAInitial   |
| St7GetNodeNSMass5                   | St7GetNodeNSMass5ID  |
| St7GetNTAFreedomPositionTable       | St7GetTransientFreedomPositionTable  |
| St7GetNTAInitialFile                | St7GetNTAInitial   |
| St7GetNTALoadPositionTable          | St7GetTransientLoadPositionTable   |
| St7GetNumSRADirectionVectors        | St7GetNumSRABaseCases  |
| St7GetPath                          | St7GetAPIPath  |
| St7GetPlateEdgeNormalShear1         | St7GetPlateEdgeTransverseShear1  |
| St7GetPlateEdgeSupport1F            | St7GetPlateEdgeSupport4  |
| St7GetPlateFaceSupport1F            | St7GetPlateFaceSupport4  |
| St7GetPlateGlobalPressure3          | St7GetPlateGlobalPressure3S  |
| St7GetPlateNormalPressure1          | St7GetPlateNormalPressure2   |

| R24 Function                    | R3 Function to Use/Comment   |
|---------------------------------|--|
| St7GetPlateNSMass5              | St7GetPlateNSMass5ID   |
| St7GetPlatePropertyData         | * See "Properties – Beams, Plates and Bricks" in API Manual.               |
| St7GetPlateResultUserEquation   | St7GetResultUserEquation   |
| St7GetQSAInitialFile            | St7GetQSAInitial   |
| St7GetResFileQuantity           | St7GetResFileQuantityState   |
| St7GetResultLimit               | * Not available in R3.   |
| St7GetResultSurfaceBricksOnly   | * Not available in R3.   |
| St7GetSeismicCaseName           | St7GetLoadCaseName   |
| St7GetSeismicNSMassCaseState    | * Seismic cases in R3 define their own non-structural mass attributes.     |
| St7GetSelectionToolBarPosition  | * Not available in R3.   |
| St7GetSRADirectionVectorFactors | St7GetSRABaseCaseFactors   |
| St7GetSRADirectionVectorTable   | St7GetSRABaseCaseTable   |
| St7GetTHAInitialFile            | St7GetTHAInitial   |
| St7GetTransientBaseResults      | St7GetResultOptions, ipResOptsBaseDisp, ipResOptsBaseVel, ipResOptsBaseAcc |
| St7GetTransientFreedomTable     | St7GetTransientFreedomTimeTable  |
| St7GetTransientLoadTable        | St7GetTransientLoadTimeTable   |
| St7GetVertexNSMass5             | St7GetVertexNSMass5ID  |
| St7HideSelectionToolBar         | St7HideWindowSelectionToolBar  |
| St7HideWindowPopUp              | * Not available in R3.   |
| St7HideWindowToolBar            | St7HideWindowEntityPanel   |
| St7HideWindowTopPanel           | St7HideWindowCombos  |
| St7ImportACISFile               | St7ImportACIS  |
| St7ImportANSYSFile              | St7ImportANSYS   |
| St7ImportDXFFile                | St7ImportDXF   |
| St7ImportIGESFile               | St7ImportIGES  |
| St7ImportNASTRANFile            | St7ImportNASTRAN   |
| St7ImportSAP2000File            | St7ImportSAP2000   |
| St7ImportST6BinaryFile          | * Not available in R3.   |
| St7ImportST6TextFile            | * Not available in R3.   |
| St7ImportST7File                | St7ImportST7   |
| St7ImportSTAADFile              | St7ImportSTAAD   |
| St7ImportSTEPFile               | St7ImportSTEP  |
| St7ImportSTLFile                | St7ImportSTL   |
| St7InsertSRADirectionVector     | St7InsertSRABaseCase   |
| St7NewSeismicCase               | St7NewLoadCase   |
| St7SaveFileTo                   | St7SaveFileCopy  |
| St7SetBeamCFG4ID                | St7SetBeamPointForceGlobal4ID  |
| St7SetBeamCFL4ID                | St7SetBeamPointForcePrincipal4ID   |
| St7SetBeamCMG4ID                | St7SetBeamPointMomentGlobal4ID   |
| St7SetBeamCML4ID                | St7SetBeamPointMomentPrincipal4ID  |
| St7SetBeamDLG6ID                | St7SetBeamDistributedForceGlobal6ID  |
| St7SetBeamDLL6ID                | St7SetBeamDistributedForcePrincipal6ID                                     |
| St7SetBeamDML6ID                | St7SetBeamDistributedMomentPrincipal6ID                                    |

| R24 Function                       | R3 Function to Use/Comment   |
|------------------------------------|--|
| St7SetBeamSupport2F                | St7SetBeamSupport2   |
| St7SetBeamUseMomCurv               | St7SetBeamNonlinearMode  |
| St7SetBeamUsePoisson               | St7SetBeamShearModulusMode, smUsePoissonsRatio   |
| St7SetBeamUseShearMod              | St7SetBeamShearModulusMode, smUseShearModulus  |
| St7SetBrickNSMass5                 | St7SetBrickNSMass5ID   |
| St7SetBrickResultUserEquation      | St7SetResultUserEquation   |
| St7SetBrickSupport1F               | St7SetBrickSupport4  |
| St7SetCleanGeometryData            | St7SetCleanGeometryOptions   |
| St7SetCleanMeshData                | St7SetCleanMeshOptions   |
| St7SetEntityDisplay                | * See "Entity Display" in API Manual.  |
| St7SetFrequencyTable               | St7SetFrequencyPeriodTableType   |
| St7SetGeometryEdgeAttachment1      | St7SetGeometryCoedgeAttachment1  |
| St7SetGeometryEdgeConvection2      | St7SetGeometryCoedgeConvection2  |
| St7SetGeometryEdgeConvectionTables | St7SetGeometryCoedgeConvectionTables   |
| St7SetGeometryEdgeFlux1            | St7SetGeometryCoedgeFlux1  |
| St7SetGeometryEdgeFluxTables       | St7SetGeometryCoedgeFluxTables   |
| St7SetGeometryEdgeNormalShear1     | St7SetGeometryCoedgeTransverseShear1   |
| St7SetGeometryEdgePressure1        | St7SetGeometryCoedgePressure1  |
| St7SetGeometryEdgeRadiation2       | St7SetGeometryCoedgeRadiation2   |
| St7SetGeometryEdgeRadiationTables  | St7SetGeometryCoedgeRadiationTables  |
| St7SetGeometryEdgeRelease1         | St7SetGeometryCoedgeRelease1   |
| St7SetGeometryEdgeShear1           | St7SetGeometryCoedgeShear1   |
| St7SetGeometryEdgeSupport1F        | St7SetGeometryCoedgeSupport4   |
| St7SetGeometryFaceGlobalPressure3  | St7SetGeometryFaceGlobalPressure3S   |
| St7SetGeometryFaceNormalPressure1  | St7SetGeometryFaceNormalPressure2  |
| St7SetGeometryFaceNSMass5          | St7SetGeometryFaceNSMass5ID  |
| St7SetGeometryFaceSupport1F        | St7SetGeometryFaceSupport4   |
| St7SetHRAResultType                | St7SetHRAMode  |
| St7SetLaminateMatrices             | St7SetLaminateData   |
| St7SetLBAInitialFile               | St7SetLBAInitial   |
| St7SetLSACombinationSpectralName   | St7SetLSACombinationSRAName  |
| St7SetLSAInitialPCGFile            | St7SetInitialPCGFile   |
| St7SetLTAInitialFile               | St7SetLTAInitial   |
| St7SetModalLoadType                | St7SetHRALoadType, St7SetSRADirectionVectorType  |
| St7SetModalNodeReactionType        | * In R3, both inertia force and element force are available in the result file. See srNodeInertia in API Manual. |
| St7SetMultiPointLink               | St7SetInterpolatedMultiPointLink, St7SetUserDefinedMultiPointLink  |
| St7SetNFAInitialFile               | St7SetNFAInitial   |
| St7SetNLAInitialFile               | St7SetNLAInitial   |
| St7SetNodeNSMass5                  | St7SetNodeNSMass5ID  |
| St7SetNTAFreedomPositionTable      | St7SetTransientFreedomPositionTable  |
| St7SetNTAInitialFile               | St7SetNTAInitial   |
| St7SetNTALoadPositionTable         | St7SetTransientLoadPositionTable   |
| St7SetPlateEdgeNormalShear1        | St7SetPlateEdgeTransverseShear1  |



| R24 Function                    | R3 Function to Use/Comment   |
|---------------------------------|--|
| St7SetPlateEdgeSupport1F        | St7SetPlateEdgeSupport4  |
| St7SetPlateFaceSupport1F        | St7SetPlateFaceSupport4  |
| St7SetPlateGlobalPressure3      | St7SetPlateGlobalPressure3S  |
| St7SetPlateNormalPressure1      | St7SetPlateNormalPressure2   |
| St7SetPlateNSMass5              | St7SetPlateNSMass5ID   |
| St7SetPlateResultUserEquation   | St7SetResultUserEquation   |
| St7SetQSAInitialFile            | St7SetQSAInitial   |
| St7SetResultLimit               | * Not available in R3.   |
| St7SetResultSurfaceBricksOnly   | * Not available in R3.   |
| St7SetSeismicCaseName           | St7SetLoadCaseName   |
| St7SetSelectionToolBarPosition  | * Not available in R3.   |
| St7SetSRADirectionVectorFactors | St7SetSRABaseCaseFactors   |
| St7SetSRADirectionVectorTable   | St7SetSRABaseCaseTable   |
| St7SetTHAInitialFile            | St7SetTHAInitial   |
| St7SetTransientBaseResults      | St7SetResultOptions, ipResOptsBaseDisp, ipResOptsBaseVel, ipResOptsBaseAcc |
| St7SetTransientFreedomTable     | St7SetTransientFreedomTimeTable  |
| St7SetTransientLoadTable        | St7SetTransientLoadTimeTable   |
| St7SetVertexNSMass5             | St7SetVertexNSMass5ID  |
| St7ShowSelectionToolBar         | St7ShowWindowSelectionToolBar  |
| St7ShowWindowPopUp              | * Not available in R3. See "Model Window" in API manual.                   |
| St7ShowWindowToolBar            | St7ShowWindowEntityPanel   |
| St7ShowWindowTopPanel           | St7ShowWindowCombos  |
| St7ToolAlignBeamAxes            | St7AlignBeamAxesToUCS  |
| St7ToolAlignPlateAxes           | St7AlignPlateAxesToUCS   |
| St7ToolAttachParts              | St7CreateAttachments   |
| St7ToolConvertPatchLoads        | St7ConvertPatchLoads   |
| St7ToolPolygonToFace            | St7FaceFromBeamPolygon   |
| St7UpdateResultFileComb         | St7RetrieveResultFileComb  |

## Appendix 2 – R24 constants not available in R3

The table below lists constants that are not used in the R3 API. Where applicable, alternative constants or functions are provided.

| R24 Constant             | R3 Related Constant/Function |
|--------------------------|------------------------------|
| anUnits_g_cm_C           | usANSYS_g_cm_C               |
| anUnits_kg_m_C           | usANSYS_kg_m_C               |
| anUnits_lbm_in_F         | usANSYS_lbm_in_F             |
| anUnits_NoUnits          | usANSYS_None                 |
| anUnits_sl_ft_F          | usANSYS_sl_ft_F              |
| anUnits_T_mm_C           | usANSYS_T_mm_C               |
| AtCentroid               | spCentroid                   |
| AtGaussPoints            | spGaussPoints                |
| AtNodesAverageAll        | spNodesAverageAll            |
| AtNodesAverageNever      | spNodesAverageNever          |
| AtNodesAverageSame       | spNodesAverageSame           |
| ATTRBeamAngle            | aoBeamAngle                  |
| ATTRBeamCFG              | aoBeamCFG                    |
| ATTRBeamCFL              | aoBeamCFL                    |
| ATTRBeamCMG              | aoBeamCMG                    |
| ATTRBeamCML              | aoBeamCML                    |
| ATTRBeamConnectionUCS    | aoBeamConnectionUCS          |
| ATTRBeamConvection       | aoBeamConvection             |
| ATTRBeamCreepLoadingAge  | aoBeamCreepLoadingAge        |
| ATTRBeamDLG              | aoBeamDLG                    |
| ATTRBeamDLL              | aoBeamDLL                    |
| ATTRBeamDML              | aoBeamDML                    |
| ATTRBeamEndAttachment    | aoBeamEndAttachment          |
| ATTRBeamFlux             | aoBeamFlux                   |
| ATTRBeamHeatSource       | aoBeamHeatSource             |
| ATTRBeamInfluence        | aoBeamInfluence              |
| ATTRBeamNSMass           | aoBeamNSMass                 |
| ATTRBeamOffset           | aoBeamOffset                 |
| ATTRBeamPreTension       | aoBeamPreTension             |
| ATTRBeamRadiation        | aoBeamRadiation              |
| ATTRBeamRadius           | aoBeamRadius                 |
| ATTRBeamREndRelease      | aoBeamREndRelease            |
| ATTRBeamSectionFactor    | aoBeamSectionFactor          |
| ATTRBeamStageProperty    | aoBeamStageProperty          |
| ATTRBeamStringGroup      | aoBeamStringGroup            |
| ATTRBeamSupport          | aoBeamSupport                |
| ATTRBeamTaper            | aoBeamTaper                  |
| ATTRBeamTempGradient     | aoBeamTempGradient           |
| ATTRBeamTEndRelease      | aoBeamTEndRelease            |
| ATTRBrickConvection      | aoBrickConvection            |
| ATTRBrickCreepLoadingAge | aoBrickCreepLoadingAge       |

| R24 Constant             | R3 Related Constant/Function |
|--------------------------|------------------------------|
| ATTRBrickFaceAttachment  | aoBrickFaceAttachment        |
| ATTRBrickFaceFoundation  | aoBrickFaceFoundation        |
| ATTRBrickFlux            | aoBrickFlux                  |
| ATTRBrickGlobalPressure  | aoBrickGlobalPressure        |
| ATTRBrickHeatSource      | aoBrickHeatSource            |
| ATTRBrickInfluence       | aoBrickInfluence             |
| ATTRBrickLocalAxes       | aoBrickLocalAxes             |
| ATTRBrickNSMass          | aoBrickNSMass                |
| ATTRBrickPointForce      | aoBrickPointForce            |
| ATTRBrickPreLoad         | aoBrickPreLoad               |
| ATTRBrickPressure        | aoBrickPressure              |
| ATTRBrickRadiation       | aoBrickRadiation             |
| ATTRBrickShear           | aoBrickShear                 |
| ATTRBrickSoilRatio       | aoBrickSoilRatio             |
| ATTRBrickSoilStress      | aoBrickSoilStress            |
| ATTRBrickStageProperty   | aoBrickStageProperty         |
| ATTRCableFreeLength      | aoCableFreeLength            |
| ATTRDamping              | aoDamping                    |
| ATTRForce                | aoForce                      |
| ATTRFreedom              | aoRestraint                  |
| ATTRKRotation            | aoKRotation                  |
| ATTRKTranslation         | aoKTranslation               |
| ATTRLoadPatch            | aoLoadPatch                  |
| ATTRMoment               | aoMoment                     |
| ATTRMRotation            | aoMRotation                  |
| ATTRMTranslation         | aoMTranslation               |
| ATTRNodeAcceleration     | aoNodeAcceleration           |
| ATTRNodeHeatSource       | aoNodeHeatSource             |
| ATTRNodeInfluence        | aoNodeInfluence              |
| ATTRNodeVelocity         | aoNodeVelocity               |
| ATTRNSMass               | aoNSMass                     |
| ATTRPipePressure         | aoPipePressure               |
| ATTRPipeTemperature      | aoPipeTemperature            |
| ATTRPlateAngle           | aoPlateAngle                 |
| ATTRPlateCreepLoadingAge | aoPlateCreepLoadingAge       |
| ATTRPlateEdgeAttachment  | aoPlateEdgeAttachment        |
| ATTRPlateEdgeConvection  | aoPlateEdgeConvection        |
| ATTRPlateEdgeNormalShear | aoPlateEdgeTransverseShear   |
| ATTRPlateEdgePressure    | aoPlateEdgeNormalPressure    |
| ATTRPlateEdgeRadiation   | aoPlateEdgeRadiation         |
| ATTRPlateEdgeRelease     | aoPlateEdgeRelease           |
| ATTRPlateEdgeShear       | aoPlateEdgeShear             |
| ATTRPlateEdgeSupport     | aoPlateEdgeSupport           |
| ATTRPlateFaceAttachment  | aoPlateFaceAttachment        |

| R24 Constant             | R3 Related Constant/Function                            |
|--------------------------|---|
| ATTRPlateFaceConvection  | aoPlateFaceConvection                                   |
| ATTRPlateFacePressure    | aoPlateFacePressure                                     |
| ATTRPlateFaceRadiation   | aoPlateFaceRadiation                                    |
| ATTRPlateFaceShear       | aoPlateFaceShear  |
| ATTRPlateFaceSupport     | aoPlateFaceSupport                                      |
| ATTRPlateFlux            | aoPlateFlux   |
| ATTRPlateGlobalPressure  | aoPlateGlobalPressure                                   |
| ATTRPlateHeatSource      | aoPlateHeatSource                                       |
| ATTRPlateInfluence       | aoPlateInfluence  |
| ATTRPlateNSMass          | aoPlateNSMass   |
| ATTRPlateOffset          | aoPlateOffset   |
| ATTRPlatePointForce      | aoPlatePointForce                                       |
| ATTRPlatePointMoment     | aoPlatePointMoment                                      |
| ATTRPlatePreLoad         | aoPlatePreLoad  |
| ATTRPlateSoilRatio       | aoPlateSoilRatio  |
| ATTRPlateSoilStress      | aoPlateSoilStress                                       |
| ATTRPlateStageProperty   | aoPlateStageProperty                                    |
| ATTRPlateTempGradient    | aoPlateTempGradient                                     |
| ATTRPlateThickness       | aoPlateThickness  |
| ATTRTemperature          | aoTemperature   |
| beLocal                  | * Local and principal results are both available in R3. |
| bePrincipal              | * Local and principal results are both available in R3. |
| bmLine                   | ieBeamAsLine  |
| bmSection                | ieBeamAsSection   |
| bmSolid                  | ieBeamAsSolid   |
| cfCreepFunction          | crCreepFunction   |
| cfRelaxationFunction     | crRelaxationFunction                                    |
| cmFaceColour             | St7SetFaceFill, ffFaceNumber                            |
| cmFixedColour            | St7SetFaceFill, ffColour                                |
| cmGroupColour            | St7SetFaceFill, ffGroup                                 |
| cmLoadPathColour         | St7SetPathFill, tfPathNumber                            |
| cmLoadPathGlobalColour   | St7SetPathFill, tfColour                                |
| cmLoadPathGroupColour    | St7SetPathFill, tfGroup                                 |
| cmLoadPathTemplateColour | St7SetPathFill, tfTemplate                              |
| cmPropertyColour         | St7SetFaceFill, ffProperty                              |
| crReoAntiSymmetric       | crRCAntiSymmetric                                       |
| crReoElastoPlasticIcr    | crRCElastoPlasticIcr                                    |
| crReoSimplified          | crRCSimplified  |
| crReoSymmetric           | crRCSymmetric   |
| ctBeamSupport1           | ctBeamSupportM1, ctBeamSupportP1                        |
| ctBeamSupport2           | ctBeamSupportM2, ctBeamSupportP2                        |
| ctBrickGlobalPressure    | ctBrickGlobalPressureMagnitude                          |
| ctBrickRaditionCoeff     | ctBrickRadiationCoeff                                   |
| ctBrickSoilRatioEO       | ctBrickSoilRatioEO                                      |

| R24 Constant                         | R3 Related Constant/Function                                  |
|--------------------------------------|---|
| ctBrickSoilStressKO                  | ctBrickSoilStressKO   |
| ctBrickSupport                       | ctBrickNormalSupport  |
| ctCuringNormal                       | crCementCuringNormal  |
| ctCuringRapid                        | crCementCuringRapid   |
| ctCuringSlow                         | crCementCuringSlow  |
| ctPlateEdgeNormalShear               | ctPlateEdgeTransverseShear                                    |
| ctPlateEdgePressure                  | ctPlateEdgeNormalPressure                                     |
| ctPlateEdgeSupport                   | ctPlateEdgeNormalSupport                                      |
| ctPlateFaceSupport                   | ctPlateFaceNormalSupportMinusZ, ctPlateFaceNormalSupportPlusZ |
| ctPlatePresStressZ                   | ctPlatePreStressZ   |
| ctPlatePressureGlobal                | ctPlateGlobalPressureMinusZ, ctPlateGlobalPressurePlusZ       |
| ctPlatePressureGlobalX               | ctPlateGlobalPressureXMinusZ, ctPlateGlobalPressureXPlusZ     |
| ctPlatePressureGlobalY               | ctPlateGlobalPressureYMinusZ, ctPlateGlobalPressureYPlusZ     |
| ctPlatePressureGlobalZ               | ctPlateGlobalPressureZMinusZ, ctPlateGlobalPressureZPlusZ     |
| ctPlatePressureNormal                | ctPlateNormalPressureMinusZ, ctPlateNormalPressurePlusZ       |
| ctPlateSoilRatioEO                   | ctPlateSoilRatioEO  |
| ctPlateSoilStressKO                  | ctPlateSoilStressKO   |
| dfGeometryDeleteBoth                 | dfLeaveNone   |
| dfGeometryDeleteOne                  | dfLeaveOne  |
| dfGeometryLeave                      | dfLeaveAll  |
| dmLine                               | St7SetBeamStyle, bsLine                                       |
| dmSection                            | St7SetBeamStyle, bsSection                                    |
| dmSlice                              | St7SetBeamStyle, bsSlice                                      |
| dmSolid                              | St7SetBeamStyle, bsSolid                                      |
| ERR7_APINotLicensed                  | ERR7_APIModuleNotLicensed                                     |
| ERR7_CannotFindStubFile              | * Not used in R3.   |
| ERR7_InsufficientRamToCreateImage    | ERR7_ErrorCreatingImage                                       |
| ERR7_InvalidMultiPointFactorsType    | ERR7_InvalidMultiPointType                                    |
| ERR7_InvalidPolygonToFaceParameters  | ERR7_InvalidFaceFromBeamPolygonParameters                     |
| ERR7_InvalidResOptsBeamEnvelope      | * Not used in R3.   |
| ERR7_InvalidResOptsHRASetting        | * Not used in R3.   |
| ERR7_InvalidResOptsStageDisplacement | * Not used in R3.   |
| ERR7_InvalidZipTolerance             | ERR7_InvalidTolerance   |
| ERR7_InvalidZipType                  | ERR7_InvalidToleranceType                                     |
| ERR7_NoPatchLoadsCreated             | ERR7_OperationFailed  |
| ERR7_NoPolygonWasConverted           | ERR7_OperationFailed  |
| ERR7_ResFileInvalidName              | ERR7_InvalidName  |
| ERR7_SparseSolverNotLicenced         | ERR7_SparseSolverModuleNotLicensed                            |
| ERR7_ToolOperationFailed             | ERR7_OperationFailed  |
| ERR7_UnknownSolver                   | ERR7_InvalidSolverType  |
| ERR7_UnknownUCS                      | ERR7_InvalidUCSID   |
| ERR7_ZeroPlateElements               | ERR7_NoPlateElements  |
| esThickEdge                          | St7SetFaceLineThickness                                       |
| esThinEdge                           | St7SetFaceLineThickness                                       |

| R24 Constant        | R3 Related Constant/Function  |
|---------------------|---|
| fmGlobalColour      | St7SetBeamFill, St7SetPlateFill, St7SetBrickFill  |
| fmGroupColour       | St7SetBeamFill, St7SetPlateFill, St7SetBrickFill  |
| fmGroupWireframe    | St7SetBeamFill, St7SetPlateFill, St7SetBrickFill, St7SetBeamOutline, St7SetPlateOutline, St7SetBrickOutline |
| fmOrientation       | St7SetBeamFill, St7SetPlateFill   |
| fmOutlineWireframe  | St7SetBeamFill, St7SetPlateFill, St7SetBrickFill, St7SetBeamOutline, St7SetPlateOutline, St7SetBrickOutline |
| fmPropertyColour    | St7SetBeamFill, St7SetPlateFill, St7SetBrickFill  |
| fmPropertyWireframe | St7SetBeamFill, St7SetPlateFill, St7SetBrickFill, St7SetBeamOutline, St7SetPlateOutline, St7SetBrickOutline |
| grAssembly          | ggAssemblies  |
| grAuto              | ggAuto  |
| grLevels            | ggLevels  |
| grNone              | ggNone  |
| grSubfigures        | ggSubfigures  |
| hrRelative          | * Not used in R3.   |
| hrTotal             | * Not used in R3.   |
| htVsFrequency       | hmVsFrequency   |
| htVsTime            | hmVsTime  |
| icAccC              | rqAccC  |
| icBeamCreepStrainC  | rqBeamCreepStrainC  |
| icBeamEnergyC       | rqBeamEnergyC   |
| icBeamFluxC         | rqBeamFluxC   |
| icBeamForceC        | rqBeamForceC  |
| icBeamStrainC       | rqBeamStrainC   |
| icBeamStressC       | rqBeamStressC   |
| icBeamTGradC        | rqBeamTGradC  |
| icBrickCreepStrainC | rqBrickCreepStrainC   |
| icBrickEnergyC      | rqBrickEnergyC  |
| icBrickFluxC        | rqBrickFluxC  |
| icBrickStrainC      | rqBrickStrainC  |
| icBrickStressC      | rqBrickStressC  |
| icBrickTGradC       | rqBrickTGradC   |
| icDispC             | rqDispC   |
| icNodeFluxC         | rqNodeFluxC   |
| icNodeForceC        | rqNodeForceC  |
| icPhaseC            | rqPhaseC  |
| icPlateCreepStrainC | rqPlateCreepStrainC   |
| icPlateCurvatureC   | rqPlateCurvatureC   |
| icPlateEnergyC      | rqPlateEnergyC  |
| icPlateFluxC        | rqPlateFluxC  |
| icPlateForceC       | rqPlateForceC   |
| icPlateMomentC      | rqPlateMomentC  |
| icPlateStrainC      | rqPlateStrainC  |
| icPlateStressC      | rqPlateStressC  |
| icPlateTGradC       | rqPlateTGradC   |

| R24 Constant               | R3 Related Constant/Function                              |
|----------------------------|---|
| icReactC                   | rqReactC  |
| icTempC                    | rqTempC   |
| icVelC                     | rqVelC  |
| ieColourNone               | ieGeomColourNone  |
| ieFaceColour               | ieGeomFaceColour  |
| ieGroupColour              | ieGeomGroupColour   |
| ieModelOnly                | ieGeomModelOnly   |
| ieModelPreferred           | ieGeomModelPreferred                                      |
| ieParameterOnly            | ieGeomParameterOnly                                       |
| ieParameterPreferred       | ieGeomParameterPreferred                                  |
| iePropertyColour           | ieGeomPropertyColour                                      |
| ieSeamOnlyAsRequired       | ieGeomSeamOnlyAsRequired                                  |
| ieSplitIntoHalves          | ieGeomSplitIntoHalves                                     |
| ieSplitOnFaceBoundary      | ieGeomSplitOnFaceBoundary                                 |
| ifBoundedSurface           | ieIGESBoundedSurface                                      |
| ifManifoldSolidBRep        | ieIGESManifoldSolidBRep                                   |
| ifOpenShell                | ieIGESOpenShell   |
| ifTrimmedParametricSurface | ieIGESTrimmedParametricSurface                            |
| ilAttachmentLink           | ItAttachmentLink  |
| ilCouplingLink             | ItCouplingLink  |
| ilMasterSlaveLink          | ItMasterSlaveLink   |
| ilMultiPointLink           | ItInterpolatedMultiPointLink, ItUserDefinedMultiPointLink |
| ilPinnedLink               | ItPinnedLink  |
| ilRigidLink                | ItRigidLink   |
| ilSectorSymmetryLink       | ItSectorSymmetryLink                                      |
| ilShrinkLink               | ItShrinkLink  |
| ilTwoPointLink             | ItTwoPointLink  |
| imDisplay                  | * Not used in R3. See "Model Window" in API Manual.       |
| imResults                  | * Not used in R3. See "Model Window" in API Manual.       |
| imSelect                   | * Not used in R3. See "Model Window" in API Manual.       |
| imShow                     | * Not used in R3. See "Model Window" in API Manual.       |
| imView                     | * Not used in R3. See "Model Window" in API Manual.       |
| ipAllBrickFaces            | St7CreateAttachments                                      |
| ipAngleDelta               | St7CreateAttachments                                      |
| ipAniParentHandle          | St7CreateAnimationEmbedded                                |
| ipAvShearStress1           | ipShearF1MeanShearStress                                  |
| ipAvShearStress2           | ipShearF2MeanShearStress                                  |
| ipBeamContour              | St7SetEntityContourIndex                                  |
| ipBeamDisplay              | St7SetBeamStyle   |
| ipBeamEnd1Colour           | St7SetBeamColours   |
| ipBeamEnd2Colour           | St7SetBeamColours   |
| ipBeamFilledMode           | St7SetBeamStyle   |
| ipBeamFlux                 | * See "Beam Results" in API Manual.                       |
| ipBeamGlobalColour         | St7SetBeamColours   |

| R24 Constant   | R3 Related Constant/Function         |
|--|--------------------------------------|
| ipBeamLightShade   | St7SetBeamLighting                   |
| ipBeamMoveToOffset   | St7SetBeamMoveToOffset               |
| ipBeamNumberMode   | St7SetBeamLabelStyle                 |
| ipBeamOutlineColour  | St7SetBeamColours                    |
| ipBeamOutlines   | St7SetBeamOutline                    |
| ipBeamRefNodeColour  | St7SetBeamColours                    |
| ipBeamRoundFacets  | St7SetBeamRoundFacets                |
| ipBeamSections   | St7SetBeamSlices                     |
| ipBeamShowAxes   | St7SetBeamDrawAxes                   |
| ipBeamShowOffset   | St7SetBeamOffsetNodes                |
| ipBeamShowRefNode  | St7SetBeamNRef                       |
| ipBeamShrink   | St7SetBeamShrink                     |
| ipBeamSpringAspect   | St7SetBeamSpringAspect               |
| ipBeamSpringCoils  | St7SetBeamSpringCoils                |
| ipBeamTempGradient   | * See "Beam Results" in API Manual.  |
| ipBeamThickness  | St7SetBeamLineThickness              |
| ipBrickAxes1   | St7SetBrickDrawAxes                  |
| ipBrickAxes2   | St7SetBrickDrawAxes                  |
| ipBrickAxes3   | St7SetBrickDrawAxes                  |
| ipBrickCombMean  | ipBrickCombDevMean                   |
| ipBrickContour   | St7SetEntityContourIndex             |
| ipBrickFilledMode  | St7SetBrickFill                      |
| ipBrickFluxGlobalRMS   | ipBrickFluxGlobalMagXYZ              |
| ipBrickFluxGlobalXY  | ipBrickFluxGlobalMagXY               |
| ipBrickFluxGlobalYZ  | ipBrickFluxGlobalMagYZ               |
| ipBrickFluxGlobalZX  | ipBrickFluxGlobalMagZX               |
| ipBrickFluxLocalRMS  | ipBrickFluxLocalMagxyz               |
| ipBrickFluxLocalxy   | ipBrickFluxLocalMagxy                |
| ipBrickFluxLocalyz   | ipBrickFluxLocalMagyz                |
| ipBrickFluxLocalzx   | ipBrickFluxLocalMagzx                |
| ipBrickFluxUCSRMS  | ipBrickFluxUCSMagXYZ                 |
| ipBrickFluxUCSXY   | ipBrickFluxUCSMagXY                  |
| ipBrickFluxUCSYZ   | ipBrickFluxUCSMagYZ                  |
| ipBrickFluxUCSZX   | ipBrickFluxUCSMagZX                  |
| ipBrickGlobalColour  | St7SetBrickColours                   |
| ipBrickLightShade  | St7SetBrickLighting                  |
| ipBrickNodeReactFX, pBrickNodeReactFY,<br>ipBrickNodeReactFZ | * See "Brick Results" in API Manual. |
| ipBrickNumberMode  | St7SetBrickLabelStyle                |
| ipBrickOutlineColour   | St7SetBrickColours                   |
| ipBrickOutlines  | St7SetBrickOutline                   |
| ipBrickOutlineThickness                                      | St7SetBrickLineThickness             |
| ipBrickShowAllFaces  | St7SetBrickWireframeAll              |
| ipBrickShowFreeFaces   | St7SetBrickWireframeAll              |
| ipBrickShrink  | St7SetBrickShrink                    |



| R24 Constant               | R3 Related Constant/Function                      |
|----------------------------|---|
| ipBrickUserAlpha1          | ipBrickAnisoAlpha1                                |
| ipBrickUserAlpha12         | ipBrickAnisoAlpha12                               |
| ipBrickUserAlpha2          | ipBrickAnisoAlpha2                                |
| ipBrickUserAlpha23         | ipBrickAnisoAlpha23                               |
| ipBrickUserAlpha3          | ipBrickAnisoAlpha3                                |
| ipBrickUserAlpha31         | ipBrickAnisoAlpha31                               |
| ipBrickUserConductivity1   | ipBrickAnisoConductivity1                         |
| ipBrickUserConductivity2   | ipBrickAnisoConductivity2                         |
| ipBrickUserConductivity3   | ipBrickAnisoConductivity3                         |
| ipBrickUserDampingRatio    | ipBrickAnisoDampingRatio                          |
| ipBrickUserDensity         | ipBrickAnisoDensity                               |
| ipBrickUserSpecificHeat    | ipBrickAnisoSpecificHeat                          |
| ipBrickUserViscosity       | ipBrickAnisoViscosity                             |
| ipCableSegments            | * Not used in R3.                                 |
| ipContactStiffness         | ipContactAxialStiffness                           |
| ipDegree                   | auDegree  |
| ipDeleteExisting           | St7CreateAttachments                              |
| ipDoEdges                  | St7CreateAttachments                              |
| ipDoEnds                   | St7CreateAttachments                              |
| ipDoFaces                  | St7CreateAttachments                              |
| ipEdgeColour               | St7SetFaceColours, ipFaceLineColour               |
| ipEdgeColourMode           | St7SetFaceOutline                                 |
| ipEdgeNonInterpColour      | St7SetFaceColours, ipFaceNIEdgesColour            |
| ipEdgeShow                 | St7SetFaceOutline                                 |
| ipEdgeShowNonInterp        | St7SetFaceNIEdges                                 |
| ipEdgeStyle                | St7SetFaceLineThickness                           |
| ipExportGeomColour         | ipGeomExportColour                                |
| ipExportGeomCurve          | ipGeomExportCurve                                 |
| ipExportGeomFormatProtocol | ipGeomExportFormatProtocol                        |
| ipExportGeomFullGroupPath  | ipGeomExportFullGroupPath                         |
| ipExportGeomGroupsAsLevels | ipGeomExportGroupsAsLevels                        |
| ipExportGeomKeepAnalytic   | ipGeomExportKeepAnalytic                          |
| ipExportGeomPeriodicFace   | ipGeomExportPeriodicFace                          |
| ipFaceShowControlPoints    | St7SetFaceControlPoints                           |
| ipFaceShowNormals          | St7SetFaceNormals                                 |
| ipFaceShowWireframes       | St7SetFaceFillStyle                               |
| ipFaceWireframeColour      | St7SetFaceColours                                 |
| ipFaceWireframeColourMode  | St7SetFaceFillStyle, St7SetFaceFill               |
| ipFaceWireframeDensity     | St7SetFaceWireDensity                             |
| ipFaceWireframeStyle       | St7SetFaceLighting                                |
| ipGeometryAccuracy         | St7SetToolOptions, ipToolOptsGeometryAccuracy     |
| ipGeometryAccuracyType     | St7SetToolOptions, ipToolOptsGeometryAccuracyType |
| ipGlobAccX                 | ipLoadCaseAccX                                    |
| ipGlobAccY                 | ipLoadCaseAccY                                    |

| R24 Constant                   | R3 Related Constant/Function |
|--------------------------------|------------------------------|
| ipGlobAccZ                     | ipLoadCaseAccZ               |
| ipGlobAngVelX                  | ipLoadCaseAngVelX            |
| ipGlobAngVelY                  | ipLoadCaseAngVelY            |
| ipGlobAngVelZ                  | ipLoadCaseAngVelZ            |
| ipGlobAngAccX                  | ipLoadCaseAngAccX            |
| ipGlobAngAccY                  | ipLoadCaseAngAccY            |
| ipGlobAngAccZ                  | ipLoadCaseAngAccZ            |
| ipGlobOrigX                    | ipLoadCaseOrigX              |
| ipGlobOrigY                    | ipLoadCaseOrigY              |
| ipGlobOrigZ                    | ipLoadCaseOrigZ              |
| ipImportGeomACISBodiesAsGroups | ipGeomImportGroupsAs         |
| ipImportGeomBlackReplacement   | * Not used in R3.            |
| ipImportGeomColourAsProperty   | ipGeomImportColourAsProperty |
| ipImportGeomCurvesToBeams      | ipGeomImportCurvesToBeams    |
| ipImportGeomGroupsAs           | ipGeomImportGroupsAs         |
| ipImportGeomLengthUnit         | ipGeomImportLengthUnit       |
| ipImportGeomProp               | ipGeomImportProperty         |
| ipImportGeomTol                | ipGeomImportTol              |
| ipLinkAttachmentColour         | St7SetLinkColours            |
| ipLinkCouplingColour           | St7SetLinkColours            |
| ipLinkFilledMode               | St7SetLinkOutline            |
| ipLinkGlobalColour             | St7SetLinkColours            |
| ipLinkMasterSlaveColour        | St7SetLinkColours            |
| ipLinkMultiPointColour         | St7SetLinkColours            |
| ipLinkNumberMode               | St7SetLinkLabelStyle         |
| ipLinkPinnedColour             | St7SetLinkColours            |
| ipLinkRigidColour              | St7SetLinkColours            |
| ipLinkSectorSymmColour         | St7SetLinkColours            |
| ipLinkShrinkColour             | St7SetLinkColours            |
| ipLinkTwoPointColour           | St7SetLinkColours            |
| ipLoadCaseDefAngAccX           | ipLoadCaseAngAccX            |
| ipLoadCaseDefAngAccY           | ipLoadCaseAngAccY            |
| ipLoadCaseDefAngAccZ           | ipLoadCaseAngAccZ            |
| ipLoadCaseDefAngVelX           | ipLoadCaseAngVelX            |
| ipLoadCaseDefAngVelY           | ipLoadCaseAngVelY            |
| ipLoadCaseDefAngVelZ           | ipLoadCaseAngVelZ            |
| ipLoadCaseDefLinAccX           | ipLoadCaseAccX               |
| ipLoadCaseDefLinAccY           | ipLoadCaseAccY               |
| ipLoadCaseDefLinAccZ           | ipLoadCaseAccZ               |
| ipLoadCaseDefOriginX           | ipLoadCaseOrigX              |
| ipLoadCaseDefOriginY           | ipLoadCaseOrigY              |
| ipLoadCaseDefOriginZ           | ipLoadCaseOrigZ              |
| ipLoadCaseDefRefTemp           | ipLoadCaseRefTemp            |
| ipLoadPathColour               | St7SetPathColours            |

| R24 Constant   | R3 Related Constant/Function         |
|--|--------------------------------------|
| ipLoadPathColourMode   | St7SetPathFill                       |
| ipLoadPathNumberMode   | St7SetPathLabelStyle                 |
| ipLoadPathShowDivisions  | St7SetPathDivisions                  |
| ipLoadPathThickness  | St7SetPathLineThickness              |
| ipNASTRANLoadCase  | ipNASTRANLoadCaseNSMass              |
| ipNodeNumberMode   | St7SetNodeLabelStyle                 |
| ipNodeResTemp  | ipNodeResTempFlux                    |
| ipNodeSelectedColour   | St7SetNodeColours                    |
| ipNodeShowFree   | St7SetFreeNodes                      |
| ipNodeSymbol   | St7SetNodeStyle, St7SetNodeSize      |
| ipNodeUnselectedColour   | St7SetNodeColours                    |
| ipPlateAxiResFileERT   | ipPlateAxiResFileERZ                 |
| ipPlateAxiResFileSRT   | ipPlateAxiResFileSRZ                 |
| ipPlateAxisOnPly   | St7SetPlateAxisLayer                 |
| ipPlateContour   | St7SetEntityContourIndex             |
| ipPlateDisplay   | St7SetPlateStyle                     |
| ipPlateFilledMode  | St7SetPlateFill                      |
| ipPlateFluxGlobalSRSS  | ipPlateFluxGlobalMagXYZ              |
| ipPlateFluxGlobalXY  | ipPlateFluxGlobalMagXY               |
| ipPlateFluxGlobalYZ  | ipPlateFluxGlobalMagYZ               |
| ipPlateFluxGlobalZX  | ipPlateFluxGlobalMagZX               |
| ipPlateFluxLocalxy   | ipPlateFluxLocalMagxy                |
| ipPlateFluxUCSSRSS   | ipPlateFluxUCSMagXYZ                 |
| ipPlateFluxUCSXY   | ipPlateFluxUCSMagXY                  |
| ipPlateFluxUCSYZ   | ipPlateFluxUCSMagYZ                  |
| ipPlateFluxUCSZX   | ipPlateFluxUCSMagZX                  |
| ipPlateGlobalColour  | St7SetPlateColours                   |
| ipPlateLightShade  | St7SetPlateLighting                  |
| ipPlateMoveToOffset  | St7SetPlateMoveToOffset              |
| ipPlateNumberMode  | St7SetPlateLabelStyle                |
| ipPlateNodeReactFX, ipPlateNodeReactFY,<br>ipPlateNodeReactFZ, ipPlateNodeReactMX,<br>ipPlateNodeReactMY, ipPlateNodeReactMZ | * See "Plate Results" in API Manual. |
| ipPlateOffset  | St7SetPlateOffsetNodes               |
| ipPlateOffsetColour  | St7SetPlateColours                   |
| ipPlateOutlineColour   | St7SetPlateColours                   |
| ipPlateOutlines  | St7SetPlateOutline                   |
| ipPlateOutlineThickness  | St7SetPlateLineThickness             |
| ipPlateRCConcreteStrain  | ipPlateRCUserConcreteStrain          |
| ipPlateRCSteelStress   | ipPlateRCUserSteelStress             |
| ipPlateShellResFileMidPlaneSxx   | ipPlateShellResFileSxxMidPlane       |
| ipPlateShellResFileMidPlaneSyy   | ipPlateShellResFileSyyMidPlane       |
| ipPlateShellResFileMidPlaneSxy   | ipPlateShellResFileSxyMidPlane       |
| ipPlateShellResFileZMinusSxx   | ipPlateShellResFileSxxMinusZ         |
| ipPlateShellResFileZMinusSyy   | ipPlateShellResFileSyyMinusZ         |

| R24 Constant                 | R3 Related Constant/Function                            |
|------------------------------|---|
| ipPlateShellResFileZMinusSxy | ipPlateShellResFileSxyMinusZ                            |
| ipPlateShellResFileZPlusSxx  | ipPlateShellResFileSxxPlusZ                             |
| ipPlateShellResFileZPlusSyy  | ipPlateShellResFileSyyPlusZ                             |
| ipPlateShellResFileZPlusSxy  | ipPlateShellResFileSxyPlusZ                             |
| ipPlateShowAxes              | St7SetPlateDrawAxes                                     |
| ipPlateShrink                | St7SetPlateShrink                                       |
| ipPlateZMinusColour          | St7SetPlateColours                                      |
| ipPlateZPlusColour           | St7SetPlateColours                                      |
| ipPolyToFaceDeleteBeams      | St7SetSourceAction                                      |
| ipPolyToFaceEdgeTolerance    | St7FaceFromBeamPolygon                                  |
| ipPolyToFaceFaceID           | St7FaceFromBeamPolygon                                  |
| ipPolyToFaceGroupIndex       | St7SetDefaultGroupID                                    |
| ipPolyToFaceKeepSelected     | St7SetKeepSelect  |
| ipPolyToFacePropertyNumber   | St7FaceFromBeamPolygon                                  |
| ipRadian                     | auRadian  |
| ipRefTemp                    | ipLoadCaseRefTemp                                       |
| ipReoAllowCompressionReo     | ipRCAAllowCompressionReo                                |
| ipReoCalcMethod              | ipRCCalcMethod  |
| ipReoCode                    | ipRCCode  |
| ipReoColour13                | ipRCColour13  |
| ipReoColour24                | ipRCColour24  |
| ipReoConcreteGamma           | ipRCConcreteGamma                                       |
| ipReoConcreteModulus         | ipRCConcreteModulus                                     |
| ipReoConcretePhi             | * Replaced with different parameter ipRCConcreteAlpha   |
| ipReoConcreteStrain          | ipRCConcreteStrain                                      |
| ipReoConcreteStress          | ipRCConcreteStress                                      |
| ipReoConsiderMembrane        | ipRCConsiderMembrane                                    |
| ipReoCover1                  | ipRCCover1  |
| ipReoCover2                  | ipRCCover2  |
| ipReoDiam1                   | ipRCDiam1   |
| ipReoDiam2                   | ipRCDiam2   |
| ipReoDiam3                   | ipRCDiam3   |
| ipReoDiam4                   | ipRCDiam4   |
| ipReoLayoutType              | ipRCLayoutType  |
| ipReoLimitConcreteStrain     | ipRCLimitConcreteStrain                                 |
| ipReoSpacing1                | ipRCSpacing1  |
| ipReoSpacing2                | ipRCSpacing2  |
| ipReoSpacing3                | ipRCSpacing3  |
| ipReoSpacing4                | ipRCSpacing4  |
| ipReoSteelGamma              | ipRCSteelGamma  |
| ipReoSteelMinArea            | ipRCSteelMinArea  |
| ipReoSteelModulus            | ipRCSteelModulus  |
| ipReoSteelStress             | ipRCSteelStress   |
| ipResOptsBeamEnvelope        | * Local and principal results are both available in R3. |

| R24 Constant                | R3 Related Constant/Function  |
|-----------------------------|---|
| ipResOptsHRAAcceleration    | * Not used in R3.   |
| ipResOptsHRADisplacement    | * Not used in R3.   |
| ipResOptsHRAVelocity        | * Not used in R3.   |
| ipResOptsStageDisplacement  | * Birth/initial displacements are separate result quantities in R3. |
| ipResultAxis                | ipResultSystem  |
| ipSAP2000ConvertBlackTo     | * Not used in R3.   |
| ipSeismicCaseDefAlpha       | ipSeismicCaseAlpha  |
| ipSeismicCaseDefBeta        | ipSeismicCaseBeta   |
| ipSeismicCaseDefDir         | ipSeismicCaseDir  |
| ipSeismicCaseDefh0          | ipSeismicCaseh0   |
| ipSeismicCaseDefK           | ipSeismicCaseK  |
| ipSeismicCaseDefLinAcc      | ipSeismicCaseLinAcc   |
| ipSeismicCaseDefPhi         | ipSeismicCasePhi  |
| ipSeismicCaseDefV1          | ipSeismicCaseV1   |
| ipSeismicCaseDefV2          | ipSeismicCaseV2   |
| ipSelectedOnly              | St7CreateAttachments  |
| ipSoilCCModulusB            | ipSoilCCModulusGb   |
| ipSoilCCModulusG            | ipSoilCCModulusGa   |
| ipSoilCCSetLevel            | ipSoilCCSetPropLevel  |
| ipSoilDCSetLevel            | ipSoilDCSetPropLevel  |
| ipSoilDCUsePoisson          | ipSoilDCUseBulkModulus  |
| ipSoilDPSetLevel            | ipSoilDPSetPropLevel  |
| ipSoilLSSetLevel            | ipSoilLSSetPropLevel  |
| ipSoilMCSetLevel            | ipSoilMCSetPropLevel  |
| ipStageMovedFixedNodes      | ipStageMoveFixedNodes   |
| ipToolOptsAllowSameProperty | * See St7CleanMeshOptions in API Manual.                            |
| ipTorqueStress              | ipTorqueShearStress   |
| ipTwoPointC0                | ipTwoPointConst   |
| ipUseInFirstIteration       | * Not used in R3.   |
| ipVertexFixedColour         | St7SetVertexColours   |
| ipVertexFreeColour          | St7SetVertexColours   |
| ipVertexSelectedColour      | St7SetVertexColours   |
| ipVertexSymbol              | St7SetVertexStyle, St7SetVertexSize                                 |
| ipVertexNumberMode          | St7SetVertexLabelStyle  |
| ipYieldRatio                | ipYieldAreaRatio  |
| kAccelerations              | lcAccelerations   |
| kAniAVI                     | afAniAVI  |
| kAniEXE                     | afAniEXE  |
| kAniSAF                     | afAniSAF  |
| kBeamEndRelFixed            | brFixed   |
| kBeamEndRelPartial          | brPartial   |
| kBeamEndRelReleased         | brReleased  |
| kBeamTypeBeam               | btBeam  |
| kBeamTypeCable              | btCable   |

| R24 Constant             | R3 Related Constant/Function |
|--------------------------|------------------------------|
| kBeamTypeConnection      | btConnection                 |
| kBeamTypeContact         | btContact                    |
| kBeamTypeCutoff          | btCutoff                     |
| kBeamTypeNull            | btNull                       |
| kBeamTypePipe            | btPipe                       |
| kBeamTypeSpring          | btSpring                     |
| kBeamTypeTruss           | btTruss                      |
| kBeamTypeUser            | btUser                       |
| kBrittleGap              | cbBrittle                    |
| kCircularHollow          | bsCircularHollow             |
| kCircularSolid           | bsCircularSolid              |
| kCompressionTakeup       | tuCompression                |
| kConstantDL              | dIConstant                   |
| kCruciform               | bsCruciform                  |
| kDoubleSymmetryInertiaX  | fcDoubleSymmetryInertiaX     |
| kDoubleSymmetryInertiaY  | fcDoubleSymmetryInertiaY     |
| kDoubleSymmetryInertiaZ  | fcDoubleSymmetryInertiaZ     |
| kDuctileGap              | cbDuctile                    |
| kFreeBodyInertiaRelief   | fcFreeBodyInertiaRelief      |
| kGeneralisedMooneyRivlin | rtGeneralisedMooneyRivlin    |
| kGravity                 | lcGravity                    |
| kInstantAlpha            | atInstantaneous              |
| kIntegratedAlpha         | atIntegrated                 |
| kISection                | bsISection                   |
| kLinearDL                | dILinear                     |
| kLipChannel              | bsLipChannel                 |
| kLSection                | bsLSection                   |
| kMaterialTypeAnisotropic | mtAnisotropic                |
| kMaterialTypeFluid       | mtFluid                      |
| kMaterialTypeIsotropic   | mtIsotropic                  |
| kMaterialTypeLaminate    | mtLaminate                   |
| kMaterialTypeNull        | mtNull                       |
| kMaterialTypeOrthotropic | mtOrthotropic                |
| kMaterialTypePly         | * Not used in R3.            |
| kMaterialTypeRubber      | mtRubber                     |
| kMaterialTypeSoil        | mtSoil                       |
| kMaterialTypeUserDefined | mtUserDefined                |
| kMaxDLPerBeam            | * Not used in R3.            |
| kMirrorBot               | mtBot                        |
| kMirrorLeft              | mtLeft                       |
| kMirrorLeftAndBot        | mtLeftAndBot                 |
| kMirrorLeftAndTop        | mtLeftAndTop                 |
| kMirrorLeftBotOnly       | mtLeftBotOnly                |
| kMirrorLeftTopOnly       | mtLeftTopOnly                |

| R24 Constant             | R3 Related Constant/Function |
|--------------------------|------------------------------|
| kMirrorNone              | mtNone                       |
| kMirrorRight             | mtRight                      |
| kMirrorRightAndBot       | mtRightAndBot                |
| kMirrorRightAndTop       | mtRightAndTop                |
| kMirrorRightBotOnly      | mtRightBotOnly               |
| kMirrorRightTopOnly      | mtRightTopOnly               |
| kMirrorTop               | mtTop                        |
| kMooneyRivlin            | rtMooneyRivlin               |
| kNeoHookean              | rtNeoHookean                 |
| kNodeAcc                 | rtNodeAcc                    |
| kNodeDisp                | rtNodeDisp                   |
| kNodeFlux                | rtNodeFlux                   |
| kNodeInfluence           | rtNodeInfluence              |
| kNodePhase               | rtNodePhase                  |
| kNodeReact               | rtNodeReact                  |
| kNodeTemp                | rtNodeTemp                   |
| kNodeVel                 | rtNodeVel                    |
| kNoInertia               | lcNoInertia                  |
| kNormalContact           | ctNormal                     |
| kNormalFreedom           | fcNormalFreedom              |
| kNullSection             | bsNullSection                |
| kOgden                   | rtOgden                      |
| kPlateTypeAxisymmetric   | ptAxisymmetric               |
| kPlateTypeLoadPatch      | ptLoadPatch                  |
| kPlateTypeMembrane       | ptMembrane                   |
| kPlateTypeNull           | ptNull                       |
| kPlateTypePlaneStrain    | ptPlaneStrain                |
| kPlateTypePlaneStress    | ptPlaneStress                |
| kPlateTypePlateShell     | ptPlateShell                 |
| kPlateTypeShearPanel     | ptShearPanel                 |
| kSingleSymmetryInertiaXY | fcSingleSymmetryInertiaXY    |
| kSingleSymmetryInertiaYZ | fcSingleSymmetryInertiaYZ    |
| kSingleSymmetryInertiaZX | fcSingleSymmetryInertiaZX    |
| kSquareHollow            | bsSquareHollow               |
| kSquareSolid             | bsSquareSolid                |
| kTakeupContact           | ctTakeup                     |
| kTensionContact          | ctTension                    |
| kTensionTakeup           | tuTension                    |
| kThreePoint0DL           | dIThreePoint0                |
| kThreePoint1DL           | dIThreePoint1                |
| kTopHatChannel           | bsTopHatChannel              |
| kTrapezoidalDL           | dITrapezoidal                |
| kTrapezoidHollow         | bsTrapezoidHollow            |
| kTrapezoidSolid          | bsTrapezoidSolid             |

| R24 Constant          | R3 Related Constant/Function   |
|-----------------------|--|
| kTriangleHollow       | bsTriangleHollow   |
| kTriangleSolid        | bsTriangleSolid  |
| kTriangularDL         | dITriangular   |
| kTSection             | bsTSection   |
| kUserSection          | bsBXSSection   |
| kZeroGapContact       | ctZeroGap  |
| kZSection             | bsZSection   |
| ItSeismicCase         | * Seismic cases are represented as load cases in R3.   |
| luGeomCENTIMETRE      | luGeomCentimetre   |
| luGeomFEET            | luGeomFoot   |
| luGeomINCH            | luGeomInch   |
| luGeomKILOMETRE       | luGeomKilometre  |
| luGeomMETRE           | luGeomMetre  |
| luGeomMICROINCH       | luGeomMicroinch  |
| luGeomMICRON          | luGeomMicron   |
| luGeomMIL             | luGeomMil  |
| luGeomMILES           | luGeomMile   |
| luGeomMILLIMETRE      | luGeomMillimetre   |
| luGeomNONE            | luGeomNone   |
| luGeomUNSPECIFIED     | luGeomUnspecified  |
| mpInterpolatedFactors | St7SetInterpolatedMultiPointLink, St7GetInterpolatedMultiPointLink   |
| mpUserFactors         | St7SetUserDefinedMultiPointLink, St7GetUserDefinedMultiPointLink   |
| mrElementForce        | St7SetEntityResult, srNodeReaction   |
| mrInertiaForce        | St7SetEntityResult, srNodeInertia  |
| mtAppliedLoad         | hlAppliedLoad  |
| mtBaseAcc             | slBaseAcc, hlBaseAcc   |
| mtBaseDisp            | slBaseDisp, hlBaseDisp   |
| mtBaseVel             | slBaseVel, hlBaseVel   |
| naUnits_kg_N_m        | usNASTRAN_kg_N_m   |
| naUnits_lbm_lbf_in    | usNASTRAN_lbm_lbf_in   |
| naUnits_NoUnits       | usNASTRAN_None   |
| naUnits_sl_lbf_ft     | usNASTRAN_sl_lbf_ft  |
| naUnits_sl_lbf_in     | usNASTRAN_sl_lbf_in  |
| naUnits_T_N_mm        | usNASTRAN_T_N_mm   |
| nmByElement           | St7SetNodeLabelStyle, St7SetBeamLabelStyle, St7SetPlateLabelStyle, St7SetBrickLabelStyle, St7SetLinkLabelStyle, St7SetVertexLabelStyle, St7SetFaceLabelStyle, St7SetPathLabelStyle, IsEntityNumber |
| nmByID                | St7SetNodeLabelStyle, St7SetBeamLabelStyle, St7SetPlateLabelStyle, St7SetBrickLabelStyle, St7SetLinkLabelStyle, St7SetVertexLabelStyle, St7SetFaceLabelStyle, IsIDNumber                           |
| nmByProperty          | St7SetBeamLabelStyle, St7SetPlateLabelStyle, St7SetBrickLabelStyle, St7SetFaceLabelStyle, IsPropertyNumber   |
| nmByPropertyName      | St7SetBeamLabelStyle, St7SetPlateLabelStyle, St7SetBrickLabelStyle, IsPropertyName   |
| nmNone                | St7SetNodeLabelStyle, St7SetBeamLabelStyle, St7SetPlateLabelStyle, St7SetBrickLabelStyle, St7SetLinkLabelStyle, St7SetVertexLabelStyle, St7SetFaceLabelStyle, St7SetPathLabelStyle, IsNone         |



| R24 Constant               | R3 Related Constant/Function                              |
|----------------------------|---|
| omOutlineFacet             | St7SetPlateOutlineMode, St7SetBrickOutlineMode            |
| omOutlineOff               | St7SetBeamOutline, St7SetPlateOutline, St7SetBrickOutline |
| omOutlineOn                | St7SetBeamOutline, St7SetPlateOutline, St7SetBrickOutline |
| pfNone                     | ppNone  |
| pfProjComponents           | ppProjComponents  |
| pfProjResultant            | ppProjResultant   |
| plSolid                    | iePlateAsSolid  |
| plSurface                  | iePlateAsSurface  |
| psPlateZMinus              | psPlateMinusZ   |
| psPlateZPlus               | psPlatePlusZ  |
| ptBeamAxialStressVsStrain  | ptBeamStressVsStrain                                      |
| ptTrussAxialStressVsStrain | ptBeamStressVsStrain                                      |
| reNodeDisplacement         | rvNodeDisplacement  |
| reNodeReaction             | rvNodeReaction  |
| rePlateForce               | rvPlateForce  |
| rePlateMoment              | rvPlateMoment   |
| rgPlaneXY                  | rlPlaneXY   |
| rgPlaneXYZ                 | rlPlaneXYZ  |
| rgPlaneYZ                  | rlPlaneYZ   |
| rgPlaneZX                  | rlPlaneZX   |
| rtBeamRRelease             | St7GetBeamReleaseResult                                   |
| rtBeamStrain               | rtBeamAllStrain   |
| rtBeamStress               | rtBeamAllStress   |
| rtBeamTRelease             | St7GetBeamReleaseResult                                   |
| rtBrickEnergy              | rtBrickEnergyDensity                                      |
| rtPlateEnergy              | rtPlateEnergyDensity                                      |
| rtPlateReoDesign           | rtPlateRCDesign   |
| sdBirthStage               | rtPlateNodeDisp, rtBrickNodeDisp, rtLinkNodeDisp          |
| sdForceUnit_dN             | fuSTAADDecanewton   |
| sdForceUnit_kgf            | fuSTAADKilogramForce                                      |
| sdForceUnit_kip            | fuSTAADKip  |
| sdForceUnit_kN             | fuSTAADKilonewton   |
| sdForceUnit_lbf            | fuSTAADPoundForce   |
| sdForceUnit_MN             | fuSTAADMeganewton   |
| sdForceUnit_MTf            | fuSTAADMegatonneForce                                     |
| sdForceUnit_N              | fuSTAADNewton   |
| sdInitial                  | rtPlateNodeDisp, rtBrickNodeDisp, rtLinkNodeDisp          |
| sdLengthUnit_cm            | luSTAADCentimetre   |
| sdLengthUnit_dm            | luSTAADDecimetre  |
| sdLengthUnit_ft            | luSTAADFoot   |
| sdLengthUnit_in            | luSTAADInch   |
| sdLengthUnit_km            | luSTAADKilometre  |
| sdLengthUnit_m             | luSTAADMetre  |
| sdLengthUnit_mm            | luSTAADMillimetre   |

| R24 Constant                      | R3 Related Constant/Function   |
|-----------------------------------|--|
| SE_CompositeModuleNotAvailable    | SE_CompositesModuleNotLicensed   |
| SE_InvalidSpectralVectors         | SE_SpectralCasesNotDefined   |
| SE_SpectralFactorsAllZero         | SE_SpectralExcitationsAllZero, SE_SpectralLoadExcitationsAllZero, SE_SpectralBaseExcitationsAllZero              |
| SE_SpectralFactorsNotDefined      | SE_SpectralCasesNotDefined   |
| spAutoAssignPathDivisions         | * See St7SetMovingLoadAutoDivisions in API Manual.   |
| spAutomotiveDesign                | ieSTEPAutomotiveDesign   |
| spConfigControlDesign             | ieSTEPConfigControlDesign  |
| spDrillStiffFactor                | spDrillStiffFactorQ8, spDrillStiffFactorQ4, spDrillStiffFactorT3   |
| spForceDrillCheck                 | spForceSingularityCheck  |
| spFrictionCutoffStrain            | * Not used in R3.  |
| spLumpedLoadBrick                 | * Not used in R3.  |
| spMaxNumWarnings                  | spMaxNumRepeatedMessages   |
| spNumBeamSlicesSpectral           | spNumBeamSlicesModal   |
| spSaveModalResults                | * Not used in R3.  |
| spSlidingFrictionFactor           | * Not used in R3.  |
| spSpectralReactionAsInertia       | * In R3, both inertia force and element force are available in the result file. See srNodeInertia in API Manual. |
| spStickingFrictionFactor          | * Not used in R3.  |
| stHarmonicResponseSolver          | stHarmonicResponse   |
| stLinearBucklingSolver            | stLinearBuckling   |
| stLinearStaticSolver              | stLinearStatic   |
| stLinearTransientDynamicSolver    | stLinearTransientDynamic   |
| stLoadInfluenceSolver             | stLoadInfluence  |
| stNaturalFrequencySolver          | stNaturalFrequency   |
| stNonlinearStaticSolver           | stNonlinearStatic  |
| stNonlinearTransientDynamicSolver | stNonlinearTransientDynamic  |
| stQuasiStaticSolver               | stQuasiStatic  |
| stSpectralResponseSolver          | stSpectralResponse   |
| stSteadyHeatSolver                | stSteadyHeat   |
| stTransientHeatSolver             | stTransientHeat  |
| sy3D1                             | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| sy3D2                             | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| sy3D3                             | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| syCircle1                         | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| syCircle2                         | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| syCircle3                         | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| syDisk1                           | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| syDisk2                           | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| syDot1                            | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| syDot2                            | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| syDot3                            | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| syDot4                            | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| sySquare1                         | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |
| sySquare2                         | St7SetNodeSize, St7SetNodeStyle, St7SetVertexSize, St7SetVertexStyle   |

| <b>R24 Constant</b>   | <b>R3 Related Constant/Function</b>                       |
|-----------------------|---|
| tFixedTemperature     | ntFixedTemperature  |
| tInitialTemperature   | ntInitialTemperature                                      |
| TITLEAuthor           | tbAuthor  |
| TITLECreated          | tbCreated   |
| TITLEModel            | tbTitle   |
| TITLEModified         | tbModified  |
| TITLEProject          | tbProject   |
| TITLEReference        | tbReference   |
| tReferenceTemperature | ntReferenceTemperature                                    |
| tTableTemperature     | ntTableTemperature  |
| tyFrequency           | ftFrequency   |
| tyPeriod              | ftPeriod  |
| UCSCartesian          | csCartesian   |
| UCSCylindrical        | csCylindrical   |
| UCSSpherical          | csSpherical   |
| UCSToroidal           | csToroidal  |
| vtVectorComponent     | vtVectorTranslationComponents, vtVectorRotationComponents |
| wsConstantColour      | St7SetFaceLighting  |
| wsDepthShaded         | St7SetFaceLighting  |

## Appendix 3 – Functions with different signature

The table below lists R3 functions that have a different parameter list compared with the R24 versions. These functions will generate compile time errors, and therefore are relatively easy to find and replace with the aid of the compiler.

| Function Name                      | Change Description                                 |
|------------------------------------|--|
| St7CalculateBeamSectionProperties  | ExactJ argument removed                            |
| St7DeleteResultFileCombCase        | Pos argument added                                 |
| St7GenerateHRATimeHistory          | WarningCode argument added                         |
| St7GenerateLSACombinations         | WarningCode argument added                         |
| St7GetBeamNonlinearType            | YieldType argument added                           |
| St7GetBrickSoilRatio2              | CaseNum argument removed                           |
| St7GetBrickSoilStress2             | CaseNum argument removed                           |
| St7GetCableData                    | Modified Integers array, Doubles array added       |
| St7GetElementData                  | ResultCase argument added                          |
| St7GetElementPropertySequence      | Stages array removed                               |
| St7GetLibraryID                    | uID argument removed                               |
| St7GetLibraryItemID                | uID argument removed                               |
| St7GetLibraryItemName              | uID argument removed                               |
| St7GetLibraryName                  | uID argument removed                               |
| St7GetNumLibraries                 | uID argument removed                               |
| St7GetNumLibraryItems              | uID argument removed                               |
| St7GetPlateResultMaxJunctionAngle  | State argument added                               |
| St7GetPlateSoilRatio2              | CaseNum argument removed                           |
| St7GetPlateSoilStress2             | CaseNum argument removed                           |
| St7GetTransientBaseTables          | BaseType argument added                            |
| St7GetTransientNodeHistoryCaseData | NodeNum argument added                             |
| St7OpenResultFile                  | Combinations argument changed                      |
| St7PlayAnimationFile               | pHandle argument removed, aHandle argument changed |
| St7SetBeamNonlinearType            | YieldType argument added                           |
| St7SetBrickSoilRatio2              | CaseNum argument removed                           |
| St7SetBrickSoilStress2             | CaseNum argument removed                           |
| St7SetCableData                    | Modified Integers array, Doubles array added       |
| St7SetPlateResultMaxJunctionAngle  | State argument added                               |
| St7SetPlateSoilRatio2              | CaseNum argument removed                           |
| St7SetPlateSoilStress2             | CaseNum argument removed                           |
| St7SetTransientBaseTables          | BaseType argument added                            |
| St7SetTransientNodeHistoryCaseData | NodeNum argument added                             |

## Appendix 4 – Functions with changed parameter sizes

The table below lists R3 functions that have the same parameter list as the R24 functions, but one or more of the parameters have changed in size or type (typically an array length has increased in size). Careful attention must be paid to these functions because if the size of the variable passed to the function is smaller than what the API expects, a memory access violation or unpredictable behaviour is likely to occur.

| Function Name                           | Change Description                                |
|---|---|
| St7AddStage                             | Modified Integers array                           |
| St7CloseAnimation                       | aHandle argument changed                          |
| St7CreateAnimation                      | Modified Integers array, aHandle argument changed |
| St7CreateAnimationFile                  | Modified Integers array                           |
| St7DeleteAttribute                      | Modified Integers array                           |
| St7GenerateBXS                          | Modified Doubles array                            |
| St7GetBeamPropertyData                  | Modified Integers array and BeamMaterial array    |
| St7GetBeamSectionCircularDiscretisation | Modified Integers array                           |
| St7GetBrickSoilCCMaterial               | Modified Doubles array                            |
| St7GetBrickSoilDCMaterial               | Modified Integers array and Doubles array         |
| St7GetBrickSoilDPMaterial               | Modified Integers array and Doubles array         |
| St7GetBrickSoilLSMaterial               | Modified Integers array and Doubles array         |
| St7GetBrickSoilMCMaterial               | Modified Integers array and Doubles array         |
| St7GetLaminateMatrices                  | Modified Integers array                           |
| St7GetLoadPath                          | Modified Integers array                           |
| St7GetLoadPathTemplateParameters        | Modified Integers array                           |
| St7GetModalResultsNFA                   | Modified ModalRes array                           |
| St7GetModelWindowHandle                 | Handle represented using HWND type                |
| St7GetNodeResponse                      | ResponseType argument is input, not output        |
| St7GetPlateEdgeAttachment1              | Direction argument is input, not output           |
| St7GetPlateResponse                     | ResponseType argument is input, not output        |
| St7GetPlateSoilCCMaterial               | Modified Doubles array                            |
| St7GetPlateSoilDCMaterial               | Modified Integers array and Doubles array         |
| St7GetPlateSoilDPMaterial               | Modified Integers array and Doubles array         |
| St7GetPlateSoilLSMaterial               | Modified Integers array and Doubles array         |
| St7GetPlateSoilMCMaterial               | Modified Integers array and Doubles array         |
| St7GetPointContactData                  | Modified Integers array and Doubles array         |
| St7GetReinforcementData                 | Modified Integers array and Doubles array         |
| St7GetResultOptions                     | Modified Integers array                           |
| St7GetSeismicCaseDefaults               | Modified Defaults array                           |
| St7GetShrinkLink                        | Modified Integers array                           |
| St7GetStageData                         | Modified Integers array                           |
| St7GetToolOptions                       | Modified Integers array                           |
| St7GetTwoPointLink                      | Modified Integers array and Doubles array         |
| St7InsertStage                          | Modified Integers array                           |
| St7InsertTransientNodeHistoryCase       | Changed order of arguments                        |
| St7SetBeamResultDisplay                 | Modified Integers array                           |
| St7SetBeamSectionCircularDiscretisation | Modified Integers array                           |
| St7SetBrickResultDisplay                | Modified Integers array                           |

| Function Name                    | Change Description                        |
|----------------------------------|---|
| St7SetBrickSoilCCMaterial        | Modified Doubles array                    |
| St7SetBrickSoilDCMaterial        | Modified Integers array and Doubles array |
| St7SetBrickSoilDPMaterial        | Modified Integers array and Doubles array |
| St7SetBrickSoilLSMaterial        | Modified Integers array and Doubles array |
| St7SetBrickSoilMCMaterial        | Modified Integers array and Doubles array |
| St7SetCopyFlags                  | Modified Flags array                      |
| St7SetLoadPath                   | Modified Integers array                   |
| St7SetLoadPathTemplateParameters | Modified Integers array                   |
| St7SetModelWindowParent          | Handle represented using HWND type        |
| St7SetPlateResultDisplay         | Modified Integers array                   |
| St7SetPlateSoilCCMaterial        | Modified Doubles array                    |
| St7SetPlateSoilDCMaterial        | Modified Integers array and Doubles array |
| St7SetPlateSoilDPMaterial        | Modified Integers array and Doubles array |
| St7SetPlateSoilLSMaterial        | Modified Integers array and Doubles array |
| St7SetPlateSoilMCMaterial        | Modified Integers array and Doubles array |
| St7SetPointContactData           | Modified Integers array and Doubles array |
| St7SetReinforcementData          | Modified Integers array and Doubles array |
| St7SetResultOptions              | Modified Integers array                   |
| St7SetSeismicCaseDefaults        | Modified Defaults array                   |
| St7SetShrinkLink                 | Modified Integers array                   |
| St7SetStageData                  | Modified Integers array                   |
| St7SetToolOptions                | Modified Integers array                   |
| St7SetTwoPointLink               | Modified Integers array and Doubles array |
| St7SolidTetMesh                  | Modified Integers array                   |
| St7SurfaceMesh                   | Modified Integers array                   |

## Appendix 5 - Modified constants

The table below lists constants where the value of the constant has changed but the constant name has stayed the same. If your program code uses the published constants and does not use hard coded values, the values will be updated for you when your program is recompiled. If your program code contains hard coded values in place of the constants, you will need to manually identify and update the code wherever the hard coded values have been used.

| Constant Name             |
|---------------------------|
| adMinusZ                  |
| adPlusZ                   |
| ctBeamAgeAtFirstLoading   |
| ctBeamConvectionAmbient   |
| ctBeamConvectionCoeff     |
| ctBeamHeatFlux            |
| ctBeamHeatSource          |
| ctBeamPipePressureIn      |
| ctBeamPipePressureOut     |
| ctBeamPipeTempIn          |
| ctBeamPipeTempOut         |
| ctBeamPreStrain           |
| ctBeamPreTension          |
| ctBeamRadiationAmbient    |
| ctBeamRadiationCoeff      |
| ctBeamTemperature         |
| ctBeamTempGradient1       |
| ctBeamTempGradient2       |
| ctBrickAgeAtFirstLoading  |
| ctBrickConvectionAmbient  |
| ctBrickConvectionCoeff    |
| ctBrickDeterminant        |
| ctBrickDihedral           |
| ctBrickDynamicFactor      |
| ctBrickGlobalPressureX    |
| ctBrickGlobalPressureY    |
| ctBrickGlobalPressureZ    |
| ctBrickHeatFlux           |
| ctBrickHeatSource         |
| ctBrickInternalAngle      |
| ctBrickMixedProduct       |
| ctBrickNormalPressure     |
| ctBrickNSMass             |
| ctBrickPreStrainMagnitude |
| ctBrickPreStrainX         |
| ctBrickPreStrainY         |
| ctBrickPreStrainZ         |
| ctBrickPreStressMagnitude |

| Constant Name                  |
|--------------------------------|
| ctBrickPreStressX              |
| ctBrickPreStressY              |
| ctBrickPreStressZ              |
| ctBrickRadiationAmbient        |
| ctBrickShearMagnitude          |
| ctBrickShearX                  |
| ctBrickShearY                  |
| ctBrickSoilRatioOCR            |
| ctBrickSoilStressSH            |
| ctBrickSoilStressSV            |
| ctBrickTemperature             |
| ctBrickVolume                  |
| ctPlateAgeAtFirstLoading       |
| ctPlateArea                    |
| ctPlateAxis1                   |
| ctPlateAxis2                   |
| ctPlateAxis3                   |
| ctPlateContinuousThicknessB    |
| ctPlateContinuousThicknessM    |
| ctPlateConvectionAmbient       |
| ctPlateConvectionAmbientZMinus |
| ctPlateConvectionAmbientZPlus  |
| ctPlateConvectionCoeff         |
| ctPlateConvectionCoeffZMinus   |
| ctPlateConvectionCoeffZPlus    |
| ctPlateDiscreteThicknessB      |
| ctPlateDiscreteThicknessM      |
| ctPlateDynamicFactor           |
| ctPlateEdgeShear               |
| ctPlateFaceShearMagnitude      |
| ctPlateFaceShearX              |
| ctPlateFaceShearY              |
| ctPlateHeatFlux                |
| ctPlateHeatSource              |
| ctPlateNSMass                  |
| ctPlateOffset                  |
| ctPlatePreStrainMagnitude      |
| ctPlatePreStrainX              |
| ctPlatePreStrainY              |
| ctPlatePreStrainZ              |
| ctPlatePreStressMagnitude      |
| ctPlatePreStressX              |
| ctPlatePreStressY              |
| ctPlateRadiationAmbient        |



| Constant Name                 |
|-------------------------------|
| ctPlateRadiationAmbientZMinus |
| ctPlateRadiationAmbientZPlus  |
| ctPlateRadiationCoeff         |
| ctPlateRadiationCoeffZMinus   |
| ctPlateRadiationCoeffZPlus    |
| ctPlateSoilRatioOCR           |
| ctPlateSoilStressSH           |
| ctPlateSoilStressSV           |
| ctPlateTemperature            |
| ctPlateTempGradient           |
| ERR7_InvalidToleranceType     |
| etCombEnvelopeMax             |
| etCombEnvelopeMin             |
| etFactEnvelopeMax             |
| etFactEnvelopeMin             |
| etLimitEnvelopeAbs            |
| etLimitEnvelopeMax            |
| etLimitEnvelopeMin            |
| icAppliedVectors              |
| icFromFile                    |
| icNodalVelocity               |
| ipAniCase                     |
| ipAniHeight                   |
| ipAniType                     |
| ipAniWidth                    |
| ipBeamPropCompatibleTwist     |
| ipBeamPropMirrorType          |
| ipBeamPropSectionType         |
| ipContactSubType              |
| ipFrictionModel               |
| ipFrictionYieldType           |
| ipGeometryActOnWholeModel     |
| ipGeometryDuplicateFaces      |
| ipGeometryEdgeMergeAngle      |
| ipGeometryFeatureLength       |
| ipGeometryFeatureType         |
| ipGeometryFreeEdgesOnly       |
| ipNumFrames                   |
| ipPlateAxiCombCreepEffRate    |
| ipPlateAxiResFileETT          |
| ipPlateAxiResFileEZZ          |
| ipPlateAxiResFileSTT          |
| ipPlateAxiResFileSZZ          |
| ipPlateRCBlockRatio           |

| Constant Name                      |
|------------------------------------|
| ipPlateRCSteelAreaLessBase         |
| ipRelEnd2Dir1                      |
| ipRelEnd2Dir2                      |
| ipRelEnd2Dir3                      |
| ipResOptsRotationUnit              |
| ipResOptsStrainUnit                |
| ipSAP2000DecimalSeparator          |
| ipSAP2000MergeDuplicateFreedomSets |
| ipSAP2000ThousandSeparator         |
| ipSoilDCConductivity               |
| ipSoilDCFluidLevel                 |
| ipSoilDCSpecificHeat               |
| ipSoilDPCohesion                   |
| ipSoilDPFrictionAngle              |
| ipSoilMCCohesion                   |
| ipSoilMCFrictionAngle              |
| ipSTAADForceUnit                   |
| ipSTAADLengthUnit                  |
| ipTensionLateralStiffness          |
| ipToolOptsAutoCreateProperties     |
| ipToolOptsCompatibleTriangle       |
| ipToolOptsCopyMode                 |
| ipToolOptsPlateAxisAlign           |
| ipTwoPointC1                       |
| ipTwoPointC2                       |
| ipUpdateDirection                  |
| kNumMaterialData                   |