Creating great Revit
Lighting families

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Revit Lighting families

Putting lights into a Revit project and documenting them should be easy, but somehow it isn't. There are many reasons for this but the main one is that everyone builds light families in different ways, which means they all behave differently.

You need to use families that suit your purposes and that are perfect for you.

This document is intended to help you to understand the complexities of making a great lighting family that works well in the design, documentation, calculation and rendering processes. We have tried explaining the key points in a clear and concise manner and not go into an overwhelming amount of detail. It is assumed that the reader is competent at Revit and at making parametric families.

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About us

Grant Taylor and Alex Page are the founders/directors of RevitWorks Ltd. We have over 55 years combined experience in documentation, developing documentation processes and training within the construction industry. We started using Revit within real-world projects in 2003.

When we craft our RevitWorks content we consider the whole process that BIM requires; from preliminary design to completed documentation and ensuring data can be reused to benefit the whole BIM team. Our primary motivation is to create products that enhance the working practice of all Revit users.

Grant Taylor, *NZCD (Arch)*
"The Thinker"

Alex Page, *BBSc*
"The Doer"

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The 8 Principles of Great Revit Light Families

We believe that every light family should be created to achieve the following principles in a consistent and predictable manner to allow for a great user experience
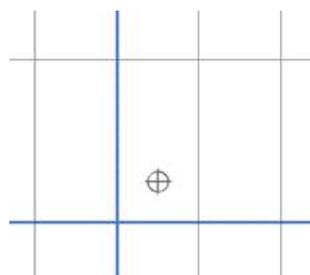
Principle 1

Flexibility of placement

All light families should be able to be placed on any surface of any object (ceilings, floors, walls, beams, stairs, furniture… anything!).
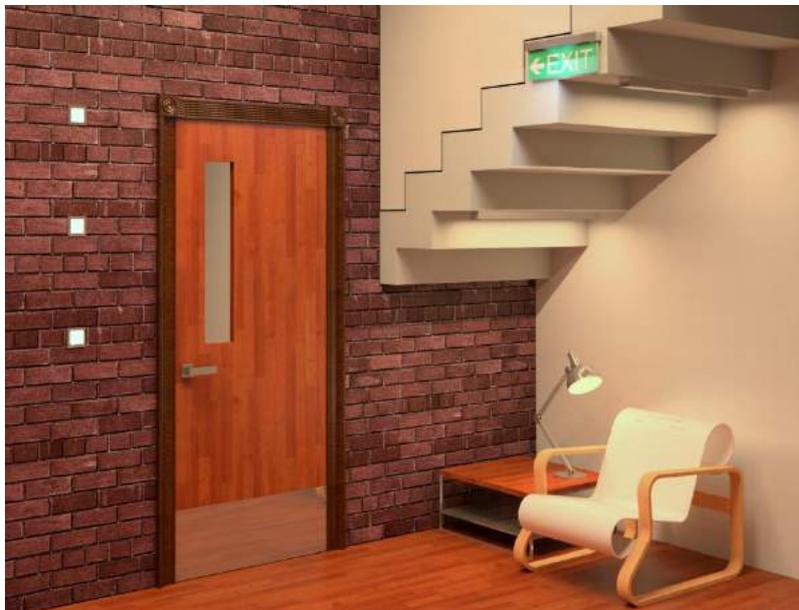
Principle 2

Snapping to ceiling grids

We can do it in CAD, so we can do it in Revit!

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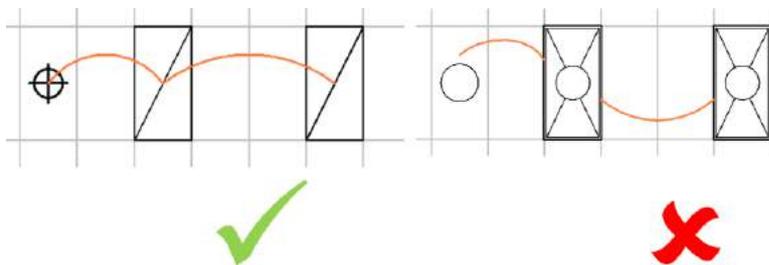
Principle 3

Consistent Symbolic Representations

All fittings must have consistent symbolic representations that match our drawing standards and can be used in our lighting legends.

Principle 4

Correctly drawn wiring diagrams

Have the electrical wiring diagrams start/end at a consistent point.

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Principle 5

Renders with fantastic lighting

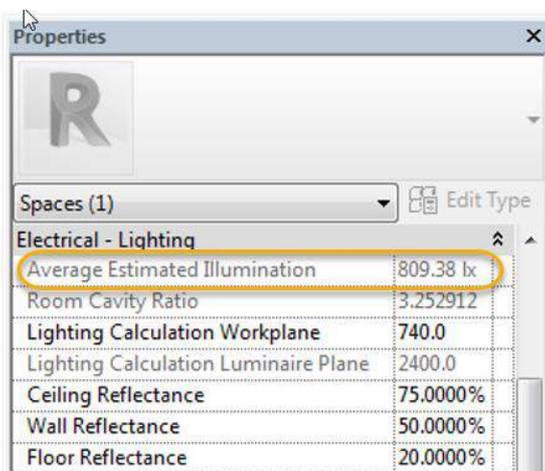## With the technology we have, why is this so difficult within Revit?

Revit has the technology to produce stunning renders. It should be a breeze, yet some users still struggle. Well configured and consistent light families are the key.
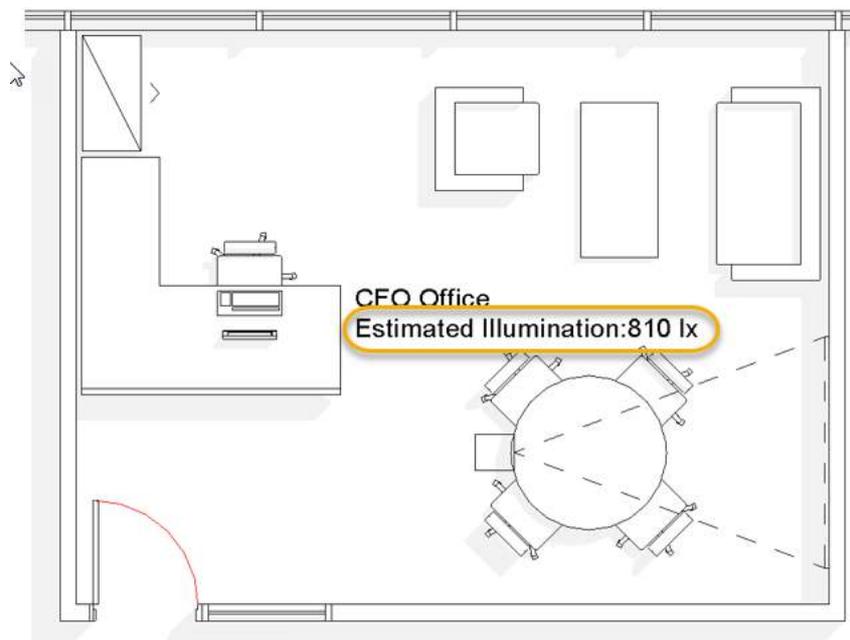
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Principle 6

Easy estimation of illumination levels

Revit has the technology under the bonnet to do this and it provides such useful design information, why aren't we using it?

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Principle 7

Creating new lights fast

It is not good enough to have a few really good light families in our library. We need to be able to create many iterations to satisfy our BIM needs.

Principle 8

Use manufacturer's information appropriately

Catalogue information, Photometric (IES files) and maybe even re-purposing the Revit content they have made (maybe).

All of the above is quite achievable by anyone using Revit and Revit LT
(except estimating illumination levels; Revit Spaces are not available within Revit LT).

If you follow the process outlined next you can achieve all of the vital 8 points above.

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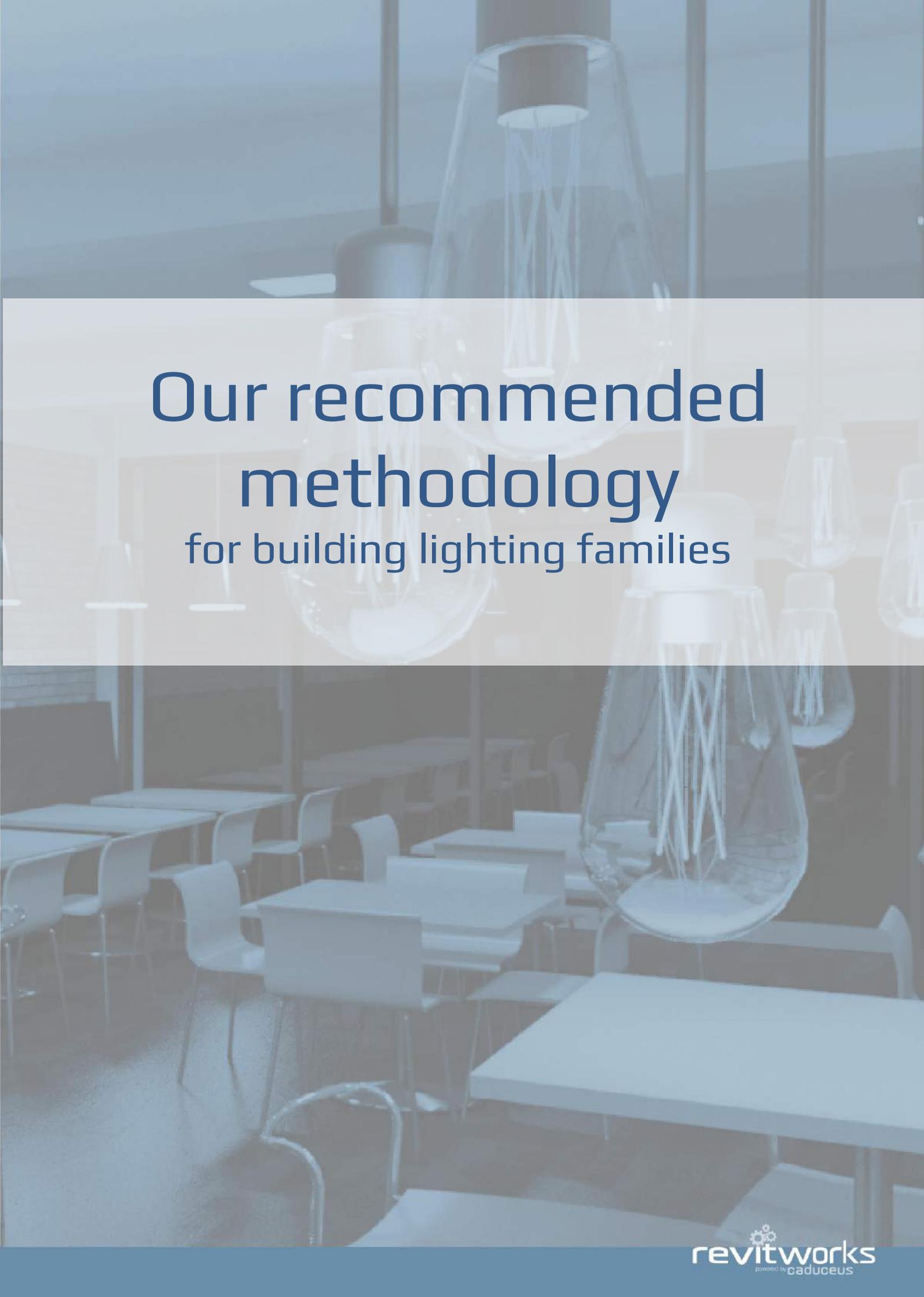
Our recommended methodology
for building lighting families

Recommendation 1

Create your "Lighting Jig"

Model   Symbol

IES File   Shared
Parameters

Why?

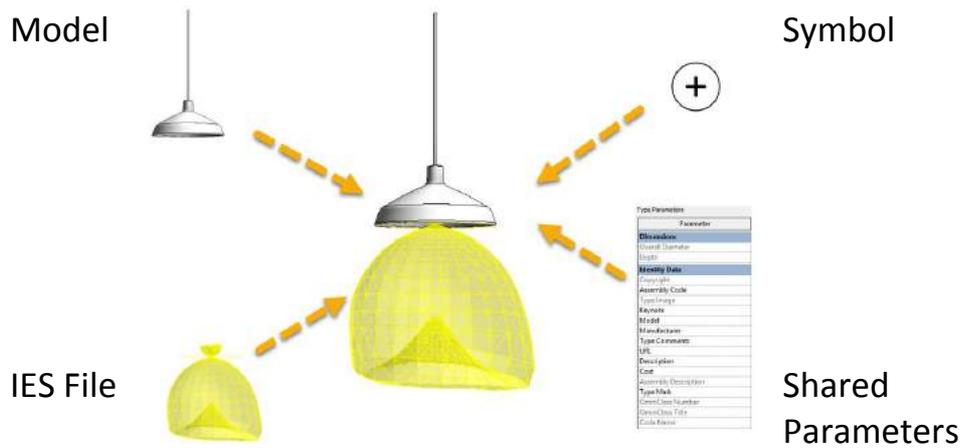*Think of this jig as your new customised lighting template made for your purpose. It means that all of your lights (if created within the jig), will have consistent user functionality and consistent schedulable parameters.*

How?

1. Use the **Generic Model faced based.rft template** as your starting point and change its family category to "Lighting Fixtures". This allows your light to be placed on any face of any object within your project or, alternatively, on any workplane.

2. Create all desired shared parameters required within this family for your scheduling purposes.

3. **Correct Wiring Diagrams** - Do not add any more **Reference Planes** (or ensure they are set to "Not a Reference"). This will help your wiring lines default to the intersection of the reference planes defining the centre of your ceiling fixture enabling neat, clean documentation (note that this doesn't always work – but is as good as you can get).

4. **Snap to Ceiling Grid** - Add **Reference Lines** and set them to be "Strong Reference" to enable alignments within your project. If you lock them to, say, 600x600 your light fixture will 'snap" to ceiling grids during placement.

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Recommendation 2

Model the actual light fitting as a separate family
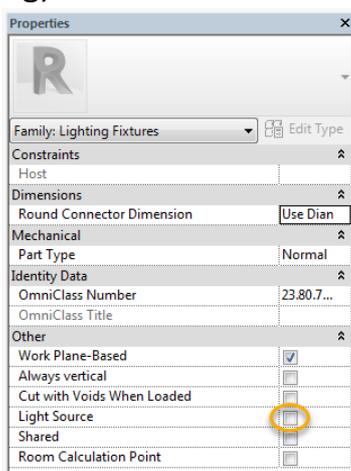
Why?

This will allow for a fast and efficient way of creating new iterations of your lights by nesting the model into other lights. Model Once – use many times.

Example: Recessed and surface mounted downlights might have the same modelled light can, but they would normally have different symbols.

How?

1. Use the **Lighting Fixture.rft template**. Your fitting will then be work plane based so it can be placed on a relevant workplane within the Jig.

2. Untick the "Light Source" Parameter (the light source will reside in your Jig).

3. Don't forget to add materials and relevant dimensional parameters if you require the light fitting to flex.

4. Save

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Recommendation 3

Model/draw the symbol as a separate family

Why?

This will allow for a fast and efficient way of creating new iterations of your lights by nesting the same symbol into other lights. Model Once – use many times.

It will also allow you to easily replace the light symbol with another.

There are 2 basic types of symbol:

- Annotative size symbols – these change according to the scale of the drawing so that they always print out the same size (i.e. A downlight symbol)

- Real world size symbols – these symbols match the actual size of the fitting (i.e. A pan fitting symbol)

How?

1. Annotative size symbols:

    a. Use the **Generic Symbol.rft template** and create all the line-work required for your annotative symbols (linework that you require to be printed at the same size regardless of the actual size of the light or the scale of the drawing). Use sub-categories to enable you to amend the lineweights within your projects.

    b. Nest into a **Metric Generic Model face based.rft template** and ensure it is "Shared ". This allows you to place it on a vertical plane within the family (as well as in plan) so it shows up when the light is placed on a vertical surface. (credit: Jose Fandos from Andekan: detailed instructions from original blog post here)

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2. Real World size symbols :

    a. Use the **Metric Generic Model face based.rft template** as your
        starting point and change its family category to "Lighting
        Fixtures". Create all the line-work required for your real-size
        symbols (linework that represents the real size of the fitting).

    b. If you use this family to nest your annotative families into (as per
        item b. above) you can have mixed annotative/ real world
   symbols in the same symbol.

Recommendation 4

Nest the fitting and the symbol families into your jig

Why?

Your lighting jig has all the required user functionality and schedulable
parameters within it.

How?

1. Open up your lighting jig and load the symbol and light fitting in using the
    "Load Family" tool.

2. Create/ Component and place these nested families onto their correct work planes.

3. Link through to the light fitting materials and dimensional parameters through to your
    jig parameters as required:

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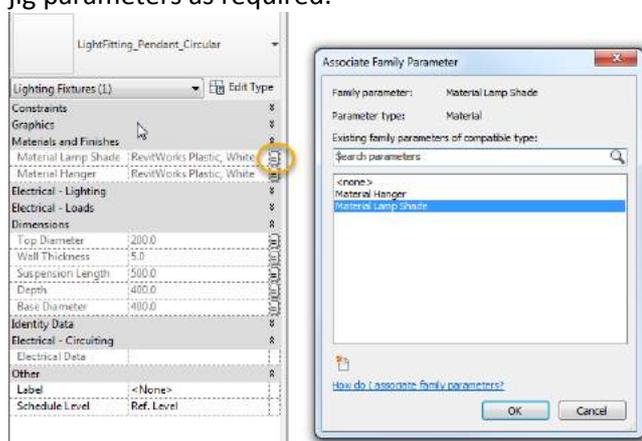
Recommendation 5

# Use IES files as the Light Source

Why?

Using IES light sources means that:

- Your fixtures light distribution look more realistic when rendered.

- Revit can estimate illumination levels.

- You can change the IES definition to the correct definition once the light has been specified without having to edit the family.

How?

1. Select the light source in your family (generally the light yellow lines). You may need to turn on the Light Source sub-category from Visibility/Graphics

2. From the Properties palette, edit the Light Source Definition.

    a. Change the Emit from Shape to match the shape of the light fitting.

    b. Change the Light distribution to IES.

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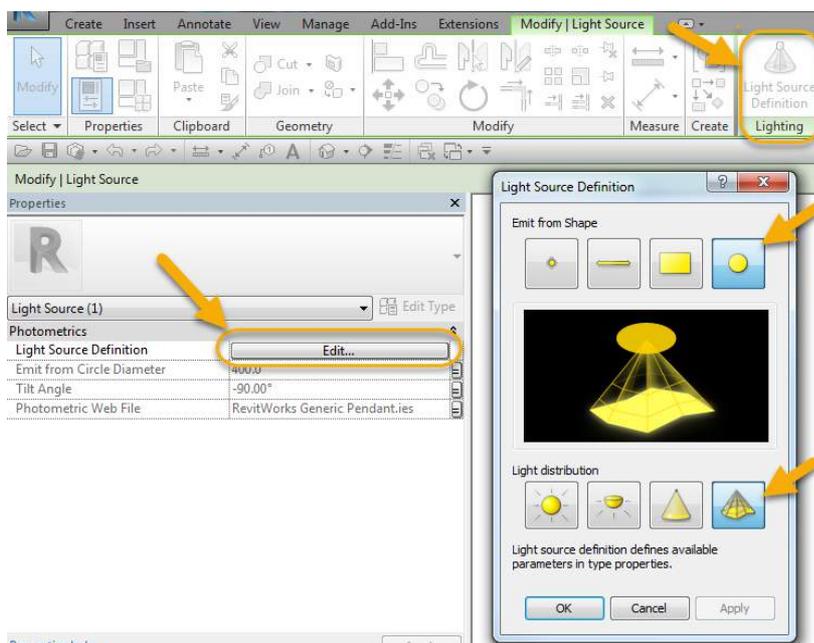
3. Now the IES file will be interchangeable within a family type parameter:
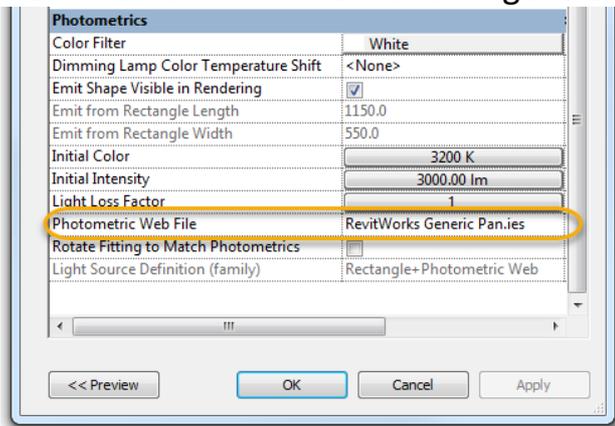
(more information on working with and choosing IES files further on)

4. You will need to put your light source slightly under your light fitting (preferably locked to a reference plane) since they won't work if they are positioned within any solid geometry. This means it can be hard to replicate exactly what the physical light fitting looks like and may take a bit of fine tuning to position the light source in the best place.

5. If you require more than one light source within your family, you will need to create light source families and nest them into your jig.

6. If you use nested light source families in your final families, you should "share" these nested families otherwise some third party lighting calculation applications will not work as expected.
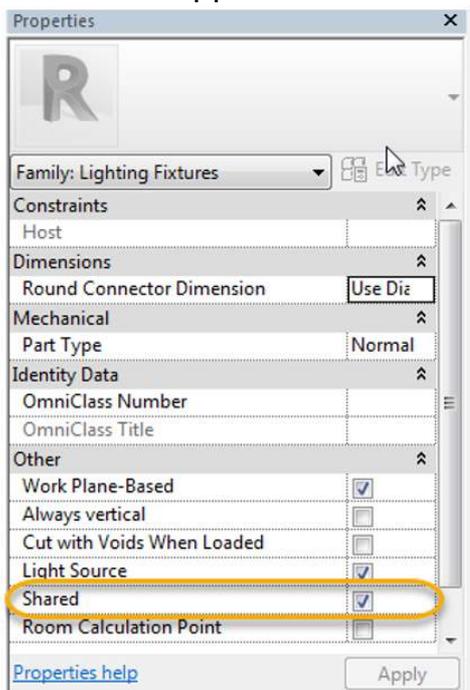
You are now ready to go … but wait … there's more!

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Recommendation 6

Expert Family builders - Additional Functionality

The features above are a great starting point for all your lights. You can also add additional functionality to those lights to really push their limits:

1. Create a sloped ceiling (and wall) solution for symbols to still show in ceiling plans.

2. Create automatic wall-ceiling symbol interchange if placed on walls instead of ceilings.

3. Allow lights to be rotated 90° on walls and symbols still show correctly

4. Add cut-plane extensions to allow low wall fittings to be shown on ceiling plans.

RevitWorks Lights come premade with ALL the features outlined above. The RevitWorks Lighting collection comes with 73 generic lights pre-made ready for your use and you can easily add your own by swapping out the nested fittings as per the methods above.

They also come with 16 generic IES files that are used by all of the RevitWorks Lighting Families. This provides a great starting point for our customers to use the lighting families straight out-of-the-box, or to copy, duplicate and customise to suit their own purposes.

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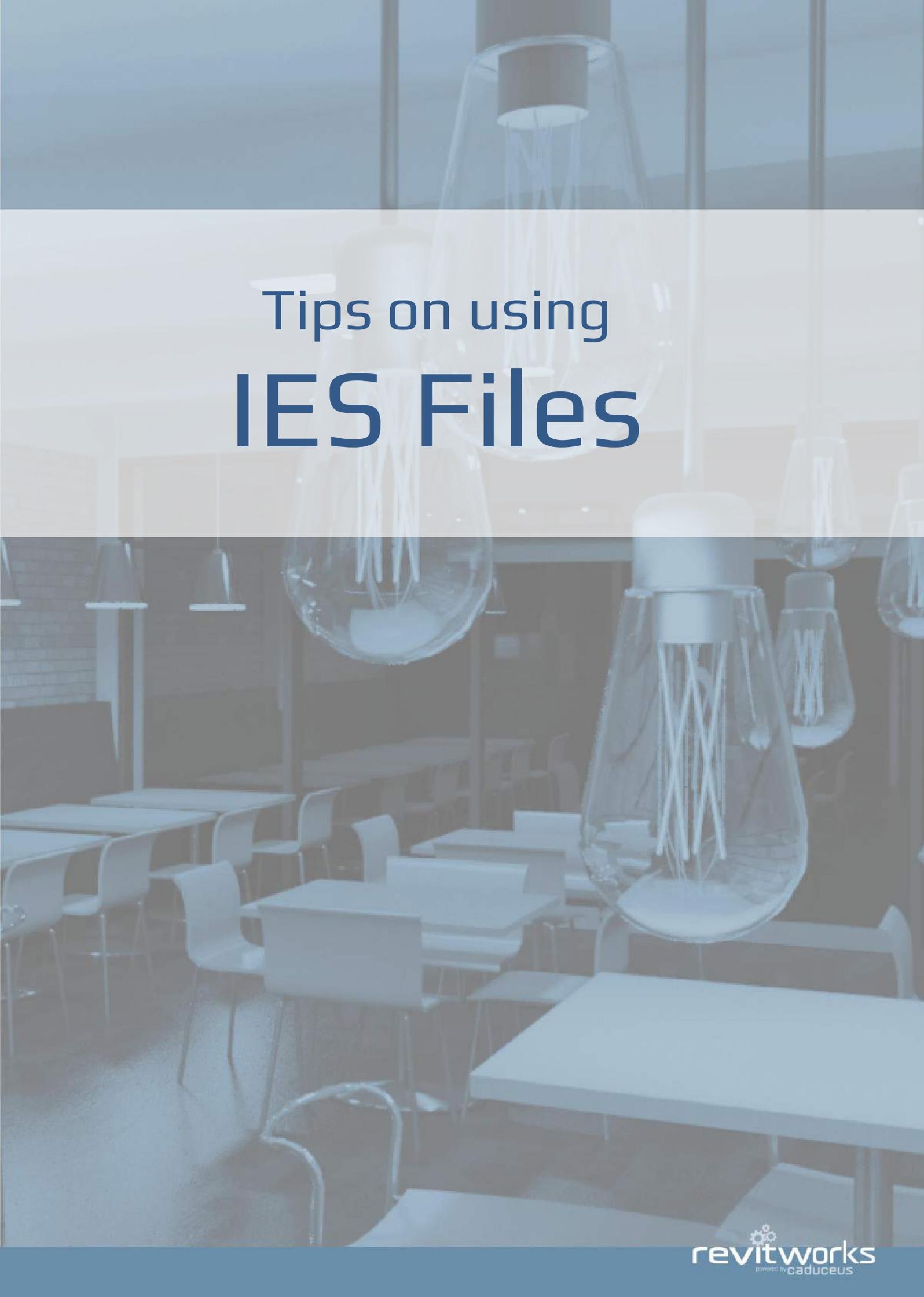
Tips on using
IES Files

IES files are text files that describe the distribution of light from a light source via points on a spherical grid. By using IES files within your lights you will achieve better lighting effects in your rendered images. Even if you don't have the exact right one, it is still beneficial to use similar ones to achieve better rendering results.

Almost all IES files are a simulation of the entire light fitting so are inaccurate when repurposing into another light fitting as they will always distribute the light as per the original fitting. Saying that, having a bunch of reasonably generic IES files to use as your starting point is very useful.

Tip 1

IES Files US standard vs. European standard

This occurs pre-Revit 2017 when using the NVidia mental ray engine when the IES file is built using the European convention since the width/ length parameters are orientated differently compared to the North American convention. You will need to edit the light and rotate the IES file to match. This will amend the orientation of the IES file for all types within that family (which is not ideal). *(This doesn't happen for cloud rendering or rendering within Revit 2017 onwards)*

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Tip 2

Rainbow Barf
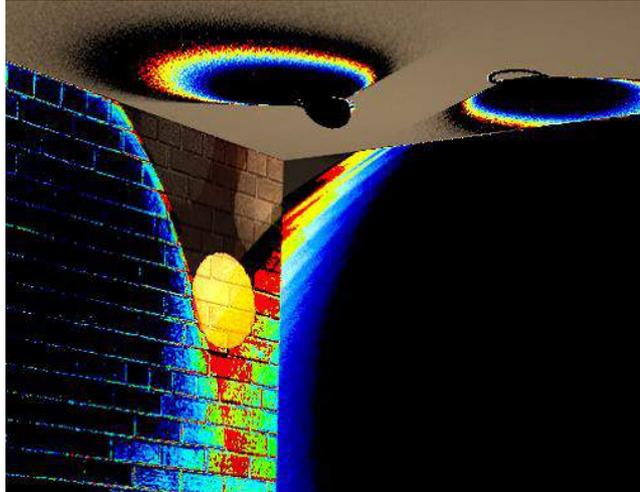
This occurs pre-Revit 2017 when using the NVidia mental ray engine and IES files that are formatted for absolute photometry (i.e. LED Fittings). Revit 2017 can now read these files correctly.

To fix in previous versions, edit the IES file with notepad (or another text editor) and scroll down to just below all the text information and "TILT=…" line to find the "-1" value

Change the "-1" to whatever the true lumen output of your lighting fixture is (say, "800"), save, open up the guilty light fitting and relink the new IES file through to the families type parameter "Photometric Web File"

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Tip 3

Our thoughts on Managing IES files

*Note: Points 1. and 2. below are suitable for preliminary design stages
(perhaps up to LOD 300) before actual light fittings have been specified.*

1. We recommend, as a starting point, repurposing existing IES files and
   creating your own generic ones that have a similar light distribution for
   your own light fittings. Revit comes with a number of IES files which are
   stored under

   C:\ProgramData\Autodesk\RVT 2017\IES
   (amend RVT 2017 with the relevant Revit version number)

   If you open any of these Autodesk IES files within Notepad (or any other
   .txt editor) you can read the luminaire description allowing you to use
   them as a starting point for your lighting families:

   *Hint! Rename them straight away to match the luminaire description as
   above: their names come coded so are very hard to interpret.*

   Some common light types with suitable Autodesk IES files are as follows:

   a. Fluorescent Surface Batten: 222T5_S.ies

   b. Bulkhead lights: 461T5_S.ies

   c. Downlights: FLH1A19.ies

2. A really good site for downloading IES files from is Erco.com, they have a
   great selection of lights, the IES files are easy to find and they seem very
   reliable.

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3. Once an IES file is used, the family remembers the information and the link to the external IES file is not necessary (i.e. the IES information travels with your light). Saying that, it pays to save and file all your IES files; they cannot be extracted from your family so if you want to use them within another family, you will need to find them again.

4. IES files do not work predictably with the Revit 2016 Autodesk Raytracer engine, but work as expected within Revit 2017 and Revit 2017 cloud rendering, within Revit 2016 cloud rendering and if used by the Revit 2016 NVidia Mental Ray engine.

5. Once you know the exact specification of the lights you are using within your project, you can then download the correct IES file from the lighting manufacturer's websites (if you can find them!) to allow for correct lighting calculations by your lighting engineer: However, lighting engineers will probably have methods of changing the IES file to the correct one within their lighting calculation programs.

    If you do repurpose IES files found elsewhere, we recommend amending the descriptions to ensure lighting engineers understand that they need to replace it with the actual manufacturer's one. This information is viewable by most engineers lighting calculation packages.

    As an example, this is what we have done with the RevitWorks generic IES files:

```
IESNA:LM-63-2002
[TEST] generic test
[TESTLAB] generic lab
[MANUFAC] -
[ISSUEDATE] 2015-09-22
[LUMINAIRE] RevitWorks generic downlight large luminaire
[MORE] For concept design and initial rendering only. Not a verified IES file.
TILT=NONE
1 2486 1 50 1 1 2  0 15  0 15 0
```
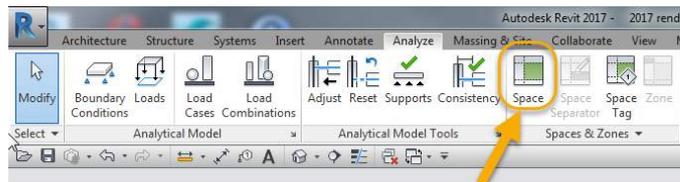
*Communication is important – let your
lighting engineers know what you have done.*

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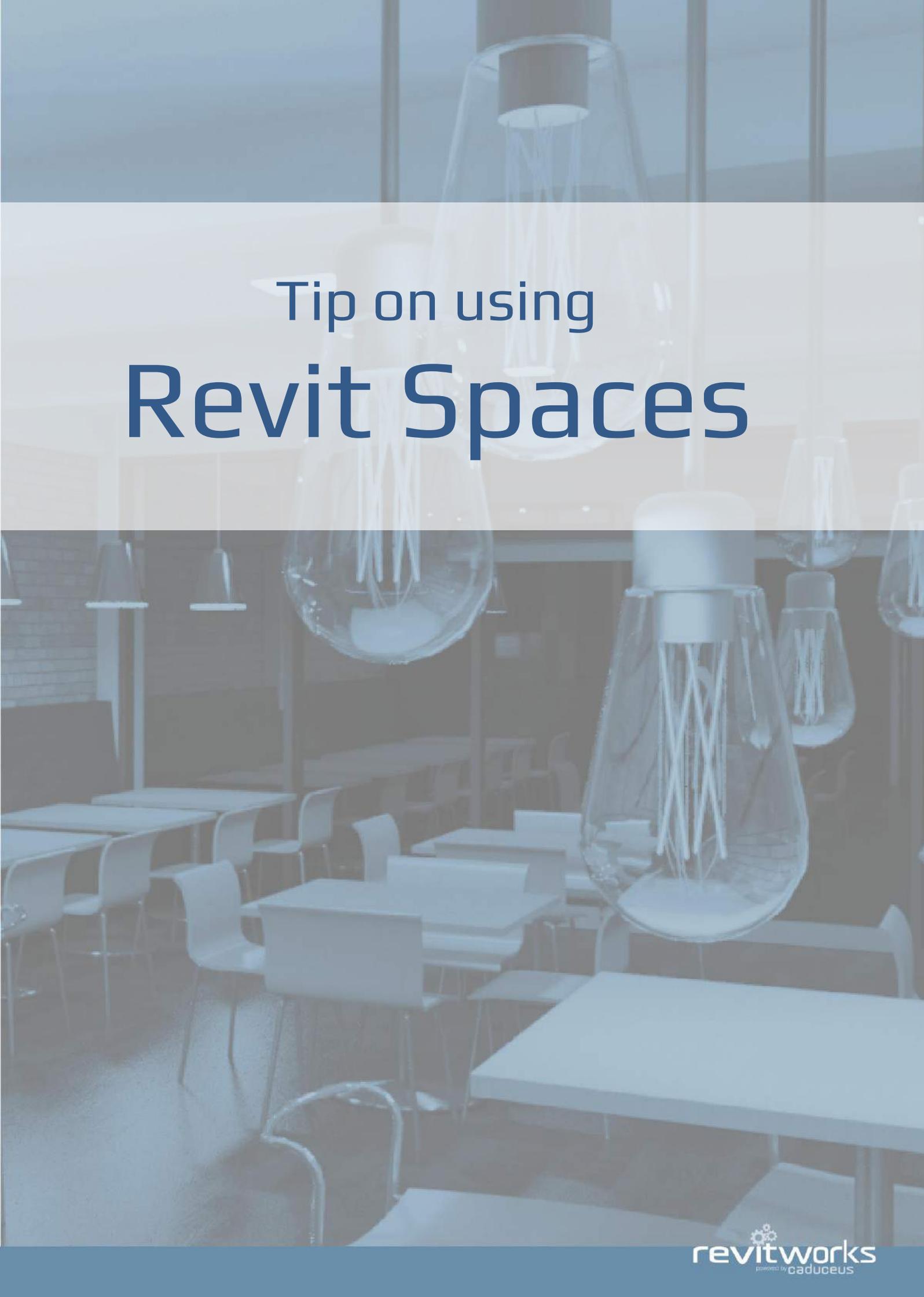
Tip on using
Revit Spaces

Tip

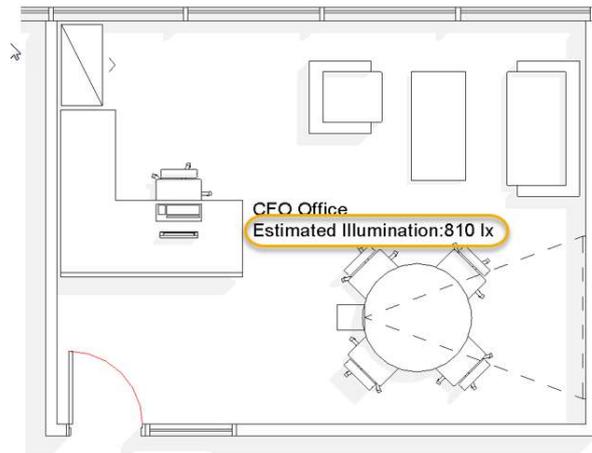# Revit Spaces & Average Estimated Illumination

If you use Revit spaces (not available within Revit LT) Revit comes with a handy tool to check your illumination levels within a space. In the spaces properties, you can guesstimate the ceiling, wall and floor reflectance values. Revit will calculate the "Average Estimated Illumination" at a certain workplane height (say, at the height of a workstation) based on the size of the space, the reflectance values of the space and the light fittings present within the space (only light fittings using IES files will be used).


The Average Estimated Illumination is an estimate and it takes the lowest light fitting in the room as the "light emitting" height for all the lights in the room (reported as the "Lighting Calculation Luminaire Plane" in the screenshot above), so if you have sloping ceilings, wall lights or floor lights the illumination value will be completely unrealistic.

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The Average Estimated Illumination is schedulable and tag-able

Sometimes the Revit "Space" instance parameter "Average Estimated Illumination" will not be calculated.
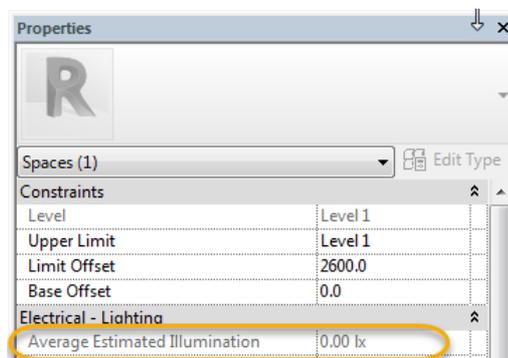
If this happens, check that the upper limit of the space is high enough to contain the ceiling lights.
If there are lights within the space, then this will likely be because within the IES file the formatting is slightly different to what Autodesk is expecting:

    a. There is an empty line in the file somewhere (or extra line at end) – delete it to fix

    b. There is a <TAB> in the file somewhere – replace with a <space> to fix

Our thoughts on
Rendering

The more the better!

Three Elements for a great Architectural Render

—

Great lights
covered here

—

Great materials
not covered here

—

A good eye for composition
that is up to you!

Light Fittings and Realism
In Architectural Renders

Architectural rendering is great for visualisation and communication with your clients as they evoke an emotive response and dialog.

We usually want architectural renders to be as close to reality as possible but that is not their main purpose. For a variety of reasons the rendered lighting effects/ distribution/ brightness never match reality: do not market your images as being exact; that is a lighting engineer's job.
Revit specific reasons for this are:

1. For the lighting in architectural renders to look realistic the lights usually require a light source and a modelled component to represent the physical light fitting. Usually, the light source should be within the modelled component for it to be technically correct but quite often this is not possible as the solid geometry of the modelled component would block the light from being emitted.
   To counter this, you may need to put your light source slightly under your light fitting for it to work as expected. This means you can't position the light source to exactly match reality, which affects the light distribution and exact shadow play.

2. Revit does not allow you to stop elements within your modelled light fittings from casting shadows - therefore the light fittings can create incorrect, and unexpected, shadow artefacts.

Lighting studies

Lighting studies are intended to show real empirical data. Revit has tools to do lighting analysis studies or link the model to more specialised software. These tools require the knowledge of a specialist lighting engineer to set up the model correctly, run the analysis and understand the results.

Quite often, the lighting engineer will substitute their own light objects that are set up to suit their specialist purposes.

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Which renderer to use

Now – the main headache you will encounter is the rendering time.

One tip: use the cloud.

You have to use cloud rendering within Revit LT, but even with standard Revit, you should be using it. Even though you will most likely have to buy cloud credits if you do a lot of rendering, the time saved certainly pays for itself: You can carry on working while it is rendering and the speed of cloud rendering means that you no longer need to worry about minimising the number of light fittings in your render, or creating lighting groups, or creating section boxes…

Did we mention you can do panoramas? Did we mention it's fast?

Example: Still render of a Café with 38 lights
(These were all done directly from Revit with no post-production work)

Revit 2017 Cloud Render: ***10 minutes***
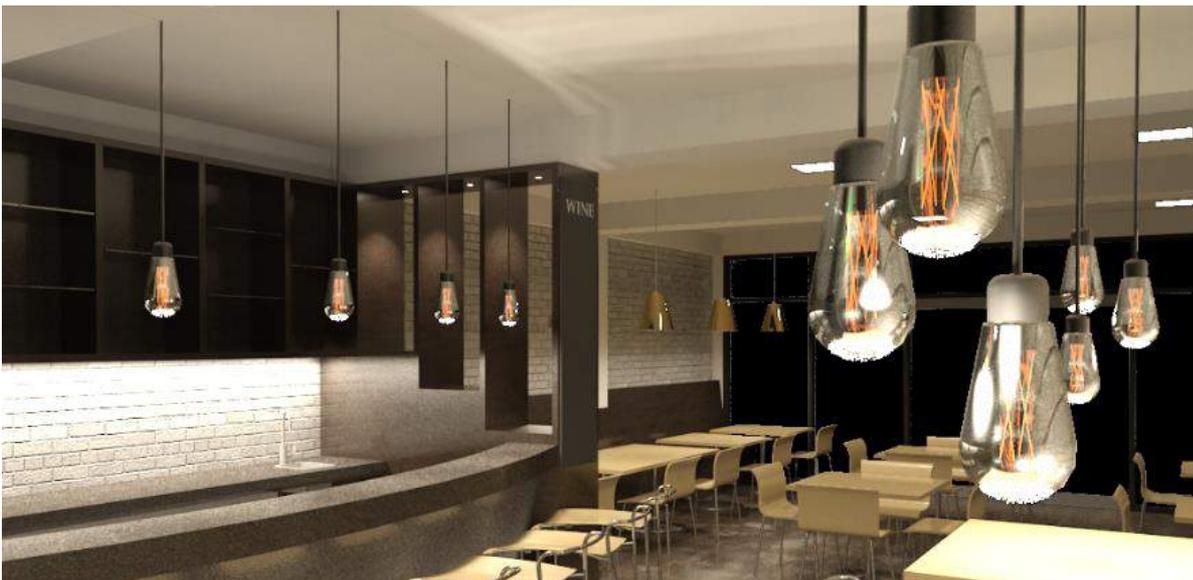
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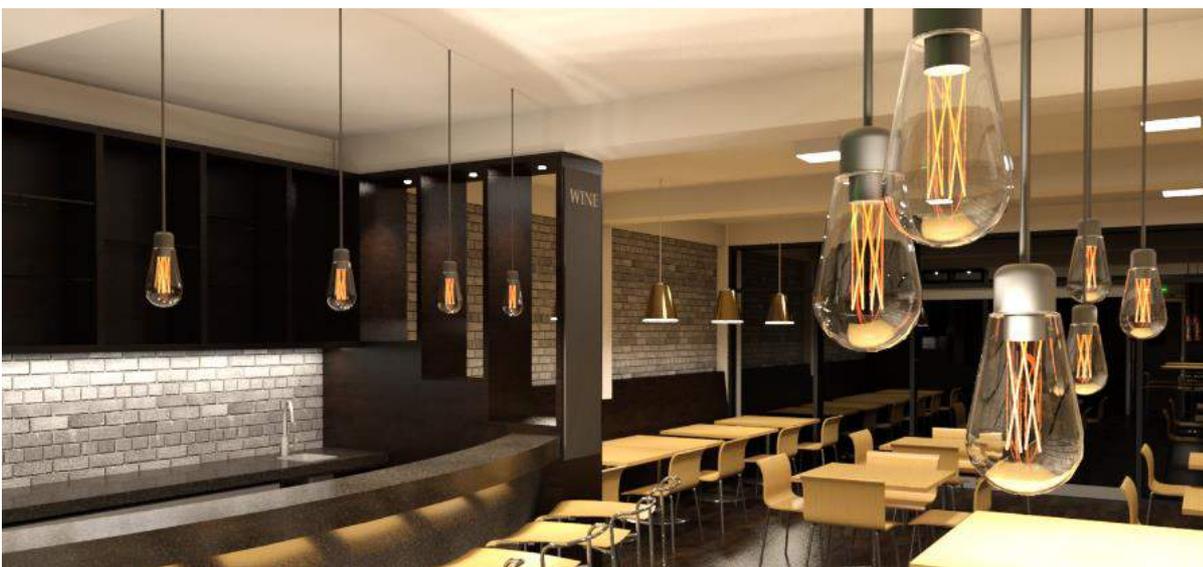
## *Revit 2017 Autodesk Raytracer Render: **40 minutes***

The image above was rendered using the default colour temperature: it can be amended through the render dialog "Adjust Exposure" "White Point" settings to closely match the cloud rendering if desired.

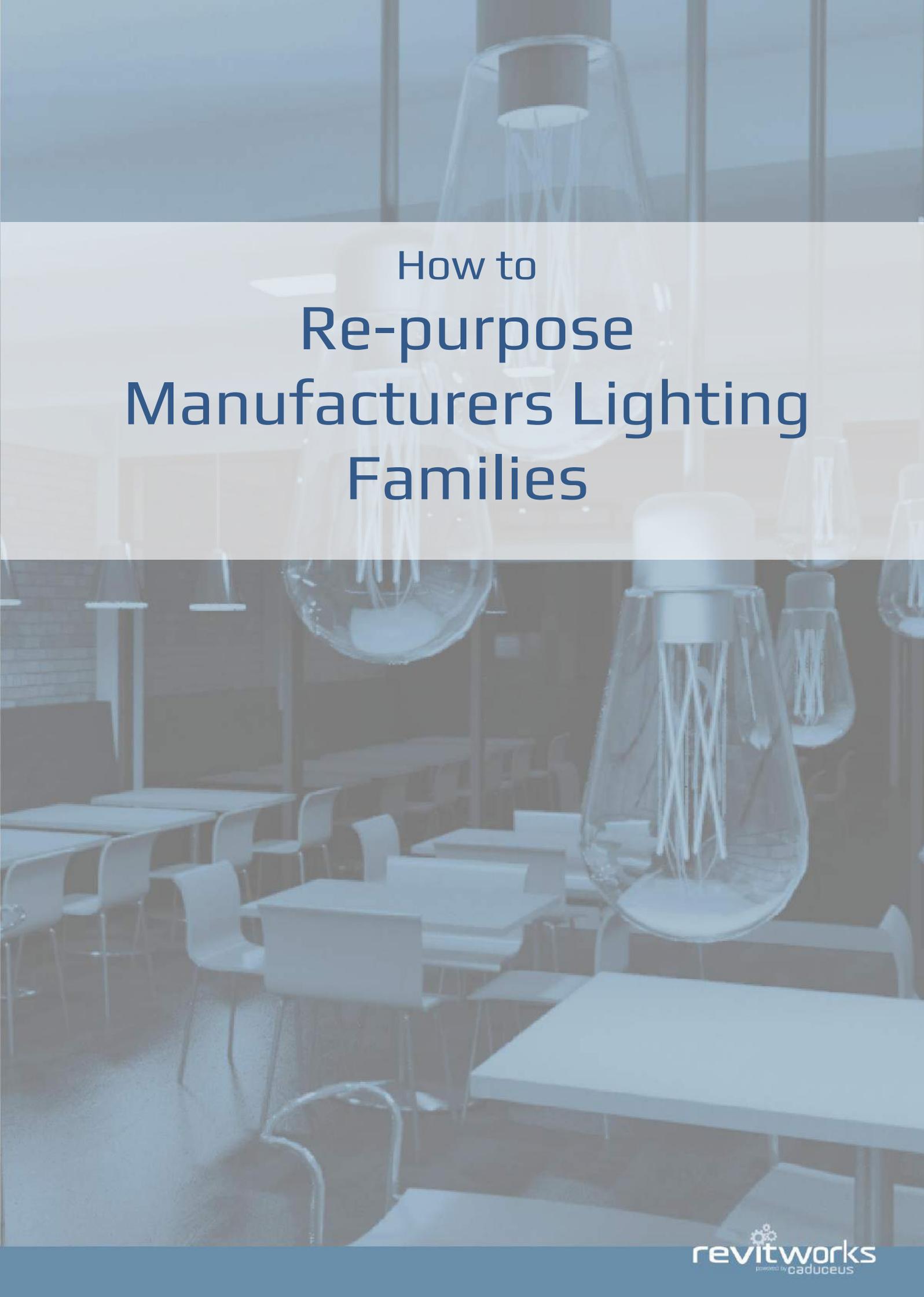## *Revit 2016 NVidia Mental Ray Render: **120 minutes***

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Turn on the Light Emit Shape

Don't forget to turn the light's shape on!

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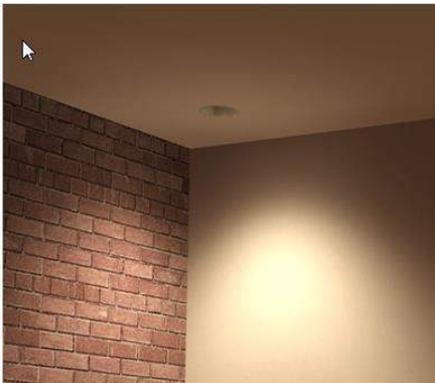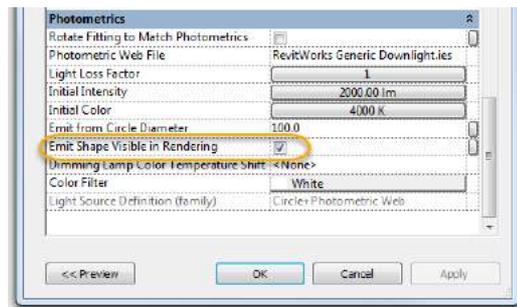
How to
Re-purpose Manufacturers Lighting Families

There are a number of problems you are likely to encounter when using manufacturers lighting families directly in your models:

1. Inconsistent and frustrating user experience between different manufacturers.

2. Symbols (if they exist at all) will probably not match your other lights/ company standards.

3. Scheduling may not work as expected since they are unlikely to have your company's shared parameters within them.

4. If not built with face based families you may not be able to place them where you want them to go.

5. Detail level could be irrelevant to your project (modelled manufacturer names etc.). Models of light fittings that are too detailed can blow-out the size of a Revit project and affect performance.

We recommend re-purposing manufacturer's lights by doing the following:

1. Edit the manufacturers light and amend the modelled elements within it (if required) to ensure the detail level suits your needs.

2. Open your lighting jig (or a similar type of light you have already created with your lighting Jig); edit the nested light fitting within it and delete all modelled elements.

3. Copy-paste the modelled elements from within the manufacturers light into your nested light fitting: ensure materials are linked to parameters Note: When copying and pasting from family file to family file, be sure not to include reference planes from the original family template in your selection. This will cause the copy and paste to fail.

4. Load back into your lighting jig, ensure the correct symbol is loaded, amend spec./ catalogue parameters to suit the new light, and "Save-As"

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Our
summary

Making Revit Lighting Families is hard.

There is a multitude of items that you need to tick off to ensure your lighting families perform in a BIM environment – let alone to ensure your Revit users have families that allow them to perform to your expectations.

Every business has their own requirements and processes. If you incorporate some or all of our recommendations you will be eliminating common roadblocks that your BIM team face when they need to add lights to their projects, as well as increasing your BIM capabilities and getting the most out of Revit.

Of course, you may think…

Too hard!..

Not enough time!..

Too busy doing your real job *(i.e. making money)*!..

Talk to us about how **we can help you develop your family library** to best suit your needs or **purchase our ready-to-use lighting families** within our Electrical collections

Suitable for standard Revit within residential and commercial projects: 73 Lights, 120 Data and Power Outlets, 50 Fire and Security Devices + the RevitWorks Elevation Reporter Add-in

Suitable for Revit LT and standard Revit within residential projects: 53 Lights, 90 Data and Power Outlets + 5 Fire and Security Devices

Purchase these Collections for less than the cost of your time to create and test your first couple of lights yourself*

*   *Standard Electrical starts at US$90 per user (minimum buy 5 user license)*
Premium Electrical starts at US$180 per user (minimum buy 5 user license)

www.revitworks.com