

# **Theatrical Lighting in an Architectural Context: Technical Considerations**

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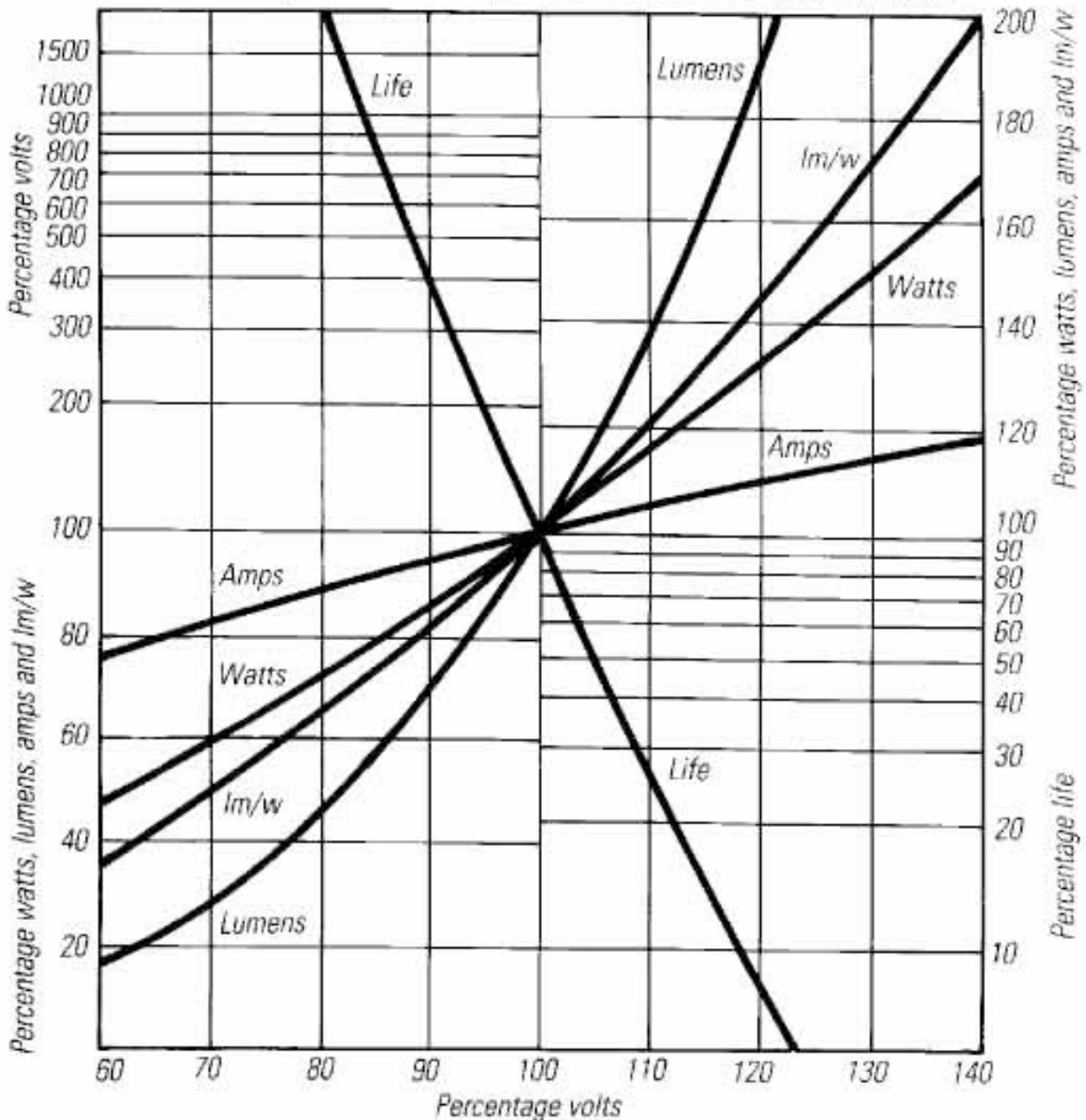
*This article is the abstract of the seminar presented at Lightfair 1997 and looks at specifics of technologies and equipment associated with theatrical lighting effects.*

## **Theatrical equipment:**

Lets look at fixtures first. Generally theatrical use means running fixtures for a few hours a day quite often at less than full intensity. This is a dramatically different pattern of use to that experienced in an architectural environment where prolonged use is more common. Some theatrical fixture manufacturers are now addressing the architectural requirement in the design of fittings, however they do not check every possible configuration of fixture, lamp, accessory and operating angle so it is necessary to perform your own tests to be assured that your situation will work.

Lamp life is another key issue. In general theatrical lamps have rated lives in the range 100 to 600 hours. This is how they achieve the incredibly high light outputs, effectively they are overrunning the lamp. Now to an extent it is possible to achieve acceptable life by dimming,

Variations of tungsten filament lamp characteristics with change in voltage



This operating curve provided by GE shows the dramatic effect on life of under running, but also look at the effect on light output! In general it is much better to find alternative lamps that offer an acceptable life, ie. 2000 hours or greater. In some cases there are straight replacements, it pays to ask further questions for even an apparently physically identical lamp may have operating characteristics that are incompatible with the proposed fixture. Key Question are:

- Light Centre Length, The exact centre of the filament in relation to the base.
- Lamp Operating Position, acceptable angles of operation from the vertical.
- Acceptable Pinch Temperature, How hot the lamp gets at the base.
- Availability, Many Catalogued lamps can be difficult to source

Often you will have to coordinate these requirements between lamp and fixture manufacturer and ensure that both will honour product warranties for the proposed combination.

Some fixture manufacturers are now offering HID adaptations to theatre fittings. This is a much more complex problem than you may think. Metal Halide lamps have a few characteristics that apparently make them ideal for complex optical systems, small arc length, long life, dramatically lower wattage for similar light output, and these can often add up to a good case for their use. They do have other characteristics that can give rise to problems.

All optical systems for fixtures are creating images of the lamp, much effort in reflector and lens design is given to providing some diffusion to break up the striation caused by imaging a grid filament. In most Metal Halide lamps the colour varies along the length of the arc depending on the operating angle of the lamp, you can get marked differences in colour across the beam as optic designs for grid filaments do not mix the light across the beam.

### **Accessories:**

In many cases we look to the use of Theatrical fixtures specifically for the accessories available to use with them. Gobos are an increasingly used tool in architecture to create moods of patterned light and projected logos or text.



*Robert Louis Stevenson Exhibition, National Museums of Scotland*

Here we have a soft ripple effect on the floor in an exhibition on Robert Louis Stevenson,



*Robert Louis Stevenson Exhibition, National Museums of Scotland*

Later in the same exhibition we are using a gobo projection more literally as a graphic element to identify a particular area.



*SDC Coffee Shop*

Here we used gobos to provide a sense of location, the shadow cast on the building by the non-existent tree and also as a graphic element for the date.

These amazingly useful items are usually etched out of stainless steel and are subjected to some incredibly high temperatures in the gate of a profile fixture. When considering specific gobos remember that, with metal gobos, you require a stencil form which is usually not a problem for abstract work, however when presenting a corporate image may be unacceptable.

Glass gobos which use a borosilicate substrate with a chrome coating allow almost photographic detail



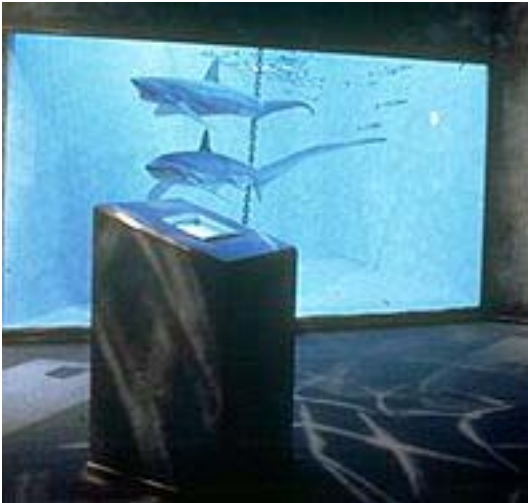
*Scottish Telecom*

In this exhibition we projected this text in the selected font style for the exhibition.

Glass Gobos need to be treated with much more delicacy than metal. To use these successfully you need fixtures that allow a true flat field adjustment, an uneven distribution of light and therefore heat across the gobo can cause heat stress failure.

Another point about gobos is that they significantly alter the ventilation pattern within the fixture as they block some or all of the airflow in through the gate. As the fixture is pointed more vertically this has an increasing effect and can cause severe lamp overheating.

Another family of accessories that can be useful in mood creation are motorised effects such as animation disks.



### *Fish Gallery*

In this gallery we extended the sense of underwater movement from the exhibit case into the space occupied by the visitor with a water ripple gobo and animation disk



### *Shiva*

For St Mungo's Museum of Religious Life & Art in Glasgow we created a custom moving effect unit to simulate the oil lamps used in temples which create a flickering light this makes the shadow move and the Image of the God to seem to dance.

If you go back to the first principals of the creation of the light you are trying to achieve it is often possible to create simple effects from easily available parts. Here we have a clock motor some obscuring glass and two dichroic lamps on a simple metal plate.

Things to watch for are robustness of mechanical systems and expected motor life in constant operation . Maintenance of sensible operating temperatures around the effects device is critical, if

these are put into small voids in ceilings with there associated, usually high wattage lamp ambient temperatures can get very high .

In general it should be remembered that the installation handling and subsequent maintenance of Theatre equipment is generally expected to be in the hands of experienced technicians. It is all too easy for a carefully set up effect to be ruined by ignorant handling during relamping or cleaning, or even by lack of cleaning with lensed fixtures.

### **Architectural Equipment:**

Just as it is possible to adapt theatrical equipment to architectural use, it is possible to create theatrical effects with appropriate architectural equipment. Many manufacturers offer fixtures aimed at providing theatrical effects, particularly gobo projectors. Some of these are pretty good however many sacrifice performance for appearance or use of parts common to other standard fixtures, as ever it is a case of buyer, or specifier beware and go and try these things out before you commit to them.

One standard problem is architectural fixture barn doors. Very few of these work as effective beam shapers, their function is either glare control or they are purely aesthetic. Also, as I mentioned previously, some theatrical manufacturers have developed Metal Halide variants for their standard fixtures to provide good lamp life and reasonable energy efficiency.

All is not hopeless however. Very minimal adaption of standard fixtures or just looking in catalogues that might not seem the most obvious can produce surprising results. Stonco, for example, produce an excellent range of fixtures for the larger sizes of PAR lamps including integral transformers for Low Voltage variants. Add to this colour glass roundels produced for fountain lights and you can be well on your way to low cost high intensity colour entirely suitable for dimmer control.

### **Lighting Control Systems**

A brief look at control would be useful at this point. Essentially a theatre dimmer and an architectural dimmer function more or less the same way, the control side differs however. In most architectural applications you simply want scenes to change n command, in a theatrical situation and in the kind of project we are looking at we need something more.



### *Scottish Power*

These slides show part of the headquarters of Scottish power. This link corridor joins the three main buildings and is used by all employees when they enter, leave and go for lunch to the canteen. Here we use a standard Lutron control system with the scenes being selected by an astronomical time clock. Each scene relies on a subtle change of lighting feel through the transition from wash lighting to path lighting mimicking the changes in daylight from morning through noon sunlight to moonlit night.

Similar effects were achieved in the Foyer with the addition of a colour changing sky courtesy of a double grid of cold cathode above the glass. We also created real "gobo" shadows punching light through the plants at night, which also provided the necessary growth lighting.

We may want to create progressive changes of mood or even rapid changes of lighting for specific effects. Some architectural systems can achieve this, others may not. The key is often the triggering device and investigation of a system's potential for working with time clocks or external triggers can often reveal a lot. It is also important to carry the control system supplier along with the project making them very aware of your intended requirements and ensuring they can meet them and be sure they provide adequate resources in terms of programming for the commissioning period.

### **Cross Over Equipment**

Theatrical suppliers are becoming more aware of the larger market in permanently installed lighting. The ever increasing Theme Park market is partly responsible as is the increased interest in theatre techniques in the retail sector. Good gobo projectors for MR16 lamps are available from several theatre sources providing you can accept the functional / theatrical aesthetic, some of the

new high efficiency T.H. source fixtures have long life lamps available for them and some of these also look pretty good!

I suppose the ultimate cross over is Varilite's Irideon system, here the full panoply of the high tech Rock & Roll moving light is available packaged for the architectural market.

Theatre colour is generally provided by "gell" These days this is either an acrylic or polyester substrate dyed in the mass or coated. These materials have limited application in architectural lighting as they require a high degree of maintenance as they change colour and the substrate becomes friable through heat and UV. In general we need to use glass, again this can be self coloured or coated. Self colour can be either specifically for lighting in which case it is usually in roundels that are used often for fountain lighting or in sheet form often called Cathedral glass used for stained glass windows. The latter is usually more fragile and based on not specifically heat resistant glass and often varies in thickness. However it does have a good range of colours.

Coated glass is usually Dichroic, this allows for a good range of saturated but often monochromatic colours which change depending on the angle of light through the colour giving rise to either nice effects or horrible fringes at the periphery of the field depending on the application!

Remember though that saturated and primary colours have less use in theatre or architecture than subtle shades where transitions between natural and artificial light can be softened or cheated and also that the perception of colour is entirely dependent on the surfaces it reflects from.



*Honours of Scotland Tableaux*

This slide shows differential colour suggesting daylight entering from the distance and the warmth of firelight or candlelight in the interior space. This tableaux is in the middle of an exhibition space.



*SDC Technology Theatre*

And here subtle grading of colour on the upper two surfaces delineates air and water on this theatre facade in the Singapore Discovery Centre.

Colour can also be introduced through specific lamp technologies from metal halide doped lamps through coloured fluorescents

## **Maintenance**

Of necessity the increased complexity of theatrical lighting solutions brings with it a maintenance overhead. You need to be very clear with clients that they are assuming an exceptional maintenance liability when accepting the design concept. Equally we bear the responsibility of assessing the likely maintenance situation when considering our specification, locating theatre fittings in hard to access locations will inevitably mean that lamps won't be changed and lenses not cleaned with acceptable frequency. Considering this aspect is probably the single most important consideration

in developing designs of a theatrical nature that will still fulfil the design intent months and years after completion.

## **Projects**

### Verdant Machines day

Usually a combination of techniques are used to solve specific problems. This shot of Verdant works Industrial museum shows part of the collection of operating Jute machinery. The space retained existing skylights however we wished to create the shadows you can see under all conditions of daylight. We used ETC source four pars under the walkway

### Verdant Loom

To model the machinery and cast shadows using the natural colour difference between dimmed tungsten and daylight to accentuate the shadows controlled by an architectural dimmer with daylight following which we programmed in reverse so the lights got brighter as the ambient light increased.

The graphic banners depicting the machines in historic photographs were lit with metal halide converted theatre profiles tightly framed to the banners so that the lighting of these did not conflict with the shadows of the machines.

### Glenkinchie Environment Wall

Here we are using a mix of low voltage gobo projectors and spots with colour to create an environment wall depicting weather changes, this is spring from a constantly changing show running for 4.5 minutes

## **Conclusion**

In conclusion I would say that you should all go and play with whatever you find from your local theatrical or architectural supplier, and think carefully about the technical issues raised by your choice of equipment. Above all have some fun with light

Kevan Shaw April 1997

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