CPNI
Centre for the Protection of National Infrastructure

FENESTRATION OBSCURATION

APPLICATION GUIDANCE

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Fenestration obscuration

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Fenestration obscuration

To prevent hostile surveillance into a building, whether an Office or a guard post, the solution, so that it is not overlooked, may be as simple as moving the window, blocking the window up or fitting opaque shutters or blinds. However this simplistic measure also prevents occupants from directly looking out and can create a claustrophobic working environment. As an alternative measures may be applied to obscure vision in through windows, these range from deploying:

- Curtains and gauzes
- Reflective and screen printed films
- Tinted or electrically controlled glass

All of the above may be supplemented by lighting measures.

The ability of an external observer to see through a window into a room and determine activity inside is dependent on a number of factors. These include the illumination level within the room, the contrast of the 'target' to background and any 'veiling effect' which may be caused by the ambient lighting around the observer (daylight) and light directed towards the observer within the same spatial field (glare lighting or reflection from glazed units – particularly where reflective films are deployed).

Who is looking into your office?

It has become common practice to apply a reflective film to building windows for reducing solar gain. This has the added benefit of obscuring the view of an observer looking in during the daylight hours. However at night, as the lighting levels outside decrease with respect to those inside, it becomes possible to see through the film and observe the actions of those inside. Experience has shown that ratio of the lighting levels, external to internal should be maintained above 7:1. This is straightforward during daylight hours but can present difficulties at night. With specific respect to 'Office' environments, the internal lighting levels will be set to match the duties undertaken in accordance with guidance given in the Chartered Institution of Building Services Engineers, CIBSE Code for Lighting and specifically Lighting Guide 7 'Office Lighting'. This means that practical control over the relative (internal / external) lighting levels is by changing external lighting. The relatively high levels of internal lighting often make the application of external lighting to the 7:1 ratio impractical.

Practical options

Having decided to implement fenestration obscuration measures there are a number of factors which must be considered that will then allow particular measures to be chosen. These include:

Key factors:

- The size of the viewable opening(s) being considered.
- Lighting levels in use inside the room being viewed, dictated by the task being undertaken (CIBSE Code for interior lighting).
- The stand-off viewing distance for the observer; can they walk past the opening or must they view from a distance.
- External influences, including planning constraints, operational issues etc.

It must also be remembered that the measures below need not be used exclusively but may be applied in combination.

Measures:

External lighting

Applicable to all measures which may be employed; the introduction of a light source into the field of view of the observer will serve to both deter and disadvantage. The lighting will also serve to aid observation out from the building. Where the location is a heritage or iconic site, the lighting should be designed as an aesthetic measure, enhancing the architectural features of the building. Consideration should be given to the Clean Neighbourhoods and Environment Act 2005 and Section 79 of the Environmental Protection Act 1990. For further guidance on the design and use of Glare Lighting refer to the CPNI Guide to Security Lighting.

Window films, reflective

Used extensively as an environmental control feature to minimise thermal gain during summer daylight hours, these films also serve to restrict visibility through windows subject to the ratio of external to internal lighting levels exceeding 7:1. These films can be retrofitted at minimal cost.

Fitting a window film

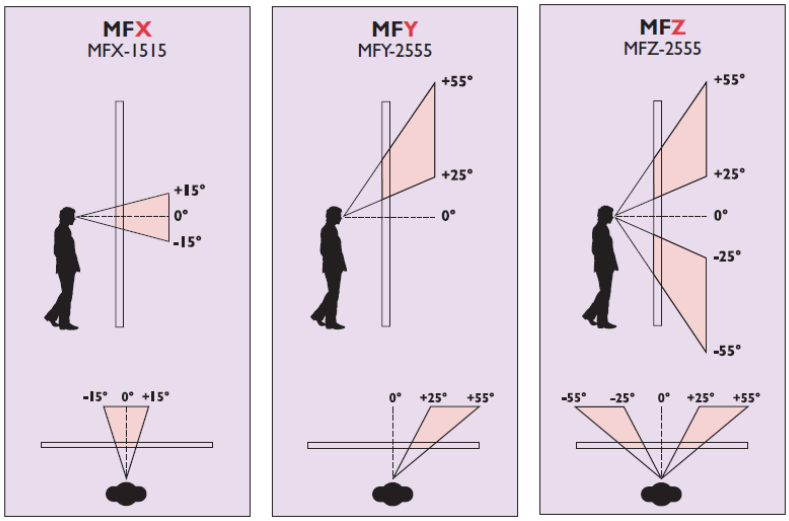
Window films, screen printed

Used for obscuration and decorative purposes they are generally more effective than the reflective films. Exploiting the way the mind handles information, they effectively mask the visual information relating to events happening behind them, the eyes focussing on the surface image. The application of these films can be such that they increase the obscuration looking in by having a light or high reflective surface toward an intruder while still allowing occupants to see out by having a dark surface facing inward. Where CCTV employs image manipulation algorithms, the effectiveness of these measures may be reduced.

Examples of Screen Printed Films

Window films, vision control

A useful variation of window film is that which has a different transmission value dependant on the angle of the observer. The film may appear clear or frosted, for example it may be possible to view straight through but not to the sides. A particular application is where the film is turned through 90 deg from that offered by the manufacturer; in this configuration it is possible for staff to look out of a window or down onto a street but attempts by a hostile observer positioned for example on the roof of an adjacent building will be frustrated.



Examples of Optical Control for Lumisty Window Film

Window films, potential problems

It would be remiss in any guide not to warn of the problems which can be met. While most windows can be retro-fitted with a film, manufacturers may not recommend this in some situations due to increased thermal stress. An example would be a dyed film on a partially shaded window: The dye absorbs solar energy and heats the glass, creating a large temperature difference between sunlit and shaded areas, possibly enough to break the glass. Other potentially problematic applications include:

- Single panes larger than 30 sq. m.
- Double panes larger than 12 sq. m.
- Clear glass thicker than 10mm
- Tinted glass thicker than 6mm
- Laminated, reflective, wired, textured or patterned glass
- Triple-pane glass
- Visibly damaged glass
- Glass where sealant or glazing compound has hardened
- Glass in concrete, solid aluminium or solid steel framing
- Tinted Glass

Further advice is available from manufacturers / installers who should be made aware of the specific requirements.

Electrically controlled glass

Electro-chromatic and liquid crystal glazed panels are becoming commercially available. These can be controlled by an applied voltage allowing the transmission factor for the panel to be changed. This can be done manually or in response to external ambient light levels. The issues around their use include high cost and limitations on physical size. It must also be noted that while obscuring vision in, they also obscure vision out.

Curtains, nets and blinds

The use of ‘bomb-blast’ curtains has the additional advantage of obscuring vision into the building, at the expense of obscuring vision out. Because they are usually white, they reflect external ambient light as a defused source toward anyone looking in. Disadvantages include the high cost and difficulty of maintenance including washing as they become dirty if they are not to become unsightly.

Blinds can be easily and cheaply installed. If required they can be operated automatically from a photocell at dusk or at predetermined times. The disadvantage is that on their own they will restrict vision out of the area**.** If required, there are a number of manufacturers who offer double glazed units which incorporate blinds between the two panes. These can be either manually or electrically operated.

Scheme variables

CPNI have undertaken trials to establish the effect of changing different variables which comprise practical Fenestration Obscuration scheme. In summary the results are as follows:

Effect of changing the internal lighting levels

Increases in internal lighting dramatically reduce the obscuration effect of the window material. This is not unexpected knowing that the effect of illumination on the eye is logarithmic.

Effect of changing the external lighting levels

There is a dramatic increase in performance between having no external lighting and low level of lighting. However while there is an increase in the obscuration obtained, with an increase to a higher lighting level, it is not as significant. This is because of the way in which the human eye responds to the 'glare' effect of the lighting.

Effect of changing the observer viewing 'stand-off' distance

The requirement of viewing distance is important and in practical applications a 'stand-off' distance from a building can usually be maintained with any observer being seen should they encroach too close. For observers the reflected light from the window causes veiling reflections in the eye obscuring the view of objects inside. This effect becomes more pronounced as viewing distance increases.

Visibility from inside a building looking out

The converse to preventing an intruder from seeing into a building is allowing the occupants to be able to see out. If this is not a requirement then it must be questioned why conventional methods such as curtains or blinds should not be used (both during the day and at night). As may be expected the effect of increasing the external lighting increases the visibility as the scene is better illuminated. The effect of increasing the internal lighting is to reduce the visibility due to the reflection from the internal wall surfaces and the effect higher lighting levels have on the eye. There is no possibility of 'night-adaption' and the pupils tend to be contracted.

Practical implementation guidance

As with any security measure, the first step is to draw up a clear Operational Requirement (OR) identifying the particular needs of different interest groups. As with all security measures, the simplest solution is usually the best (and quite often the cheapest as well).

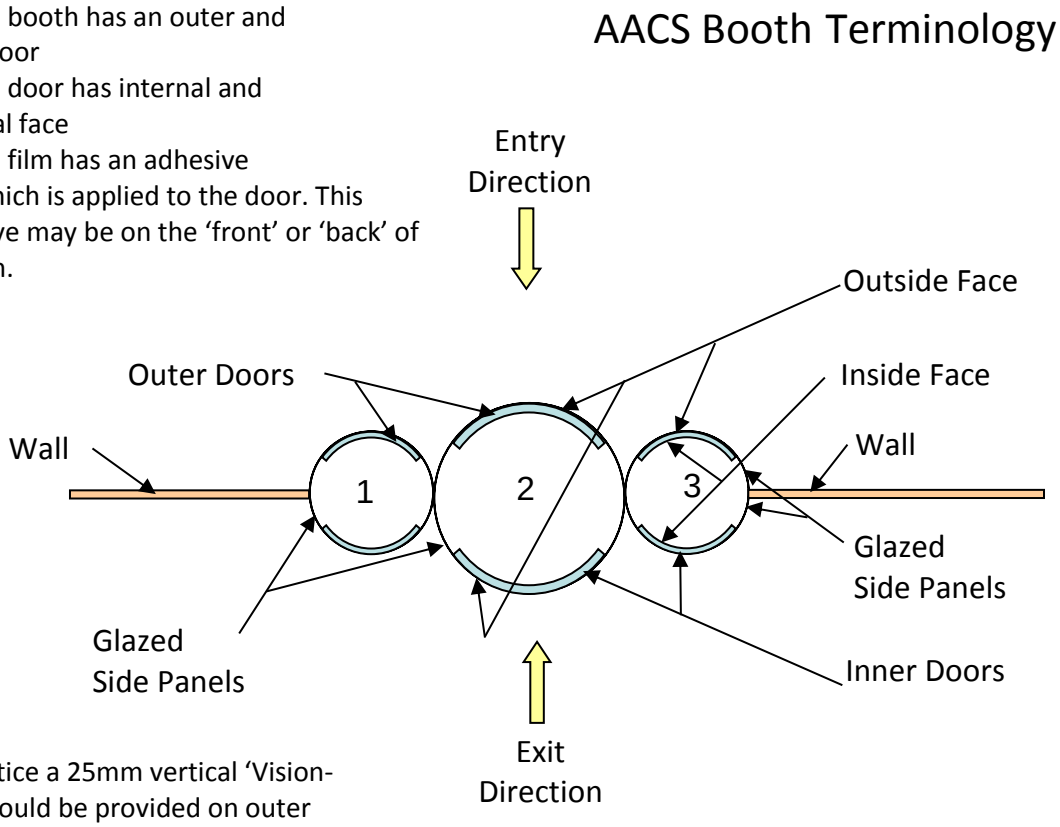
The application of any film to glazing will make it more difficult for an observer to see into the room during the day and at night. In a retrofit scenario where cost is to be minimised, Screen Printed Film should be applied to the existing glazing and changes in lighting and facia colourings should be considered.

The design should aim to achieve a lighting ratio of at least 7:1 outside to inside.

Experience has shown that in the case of booths used with Automated Access Control Systems, AACS, confusion over terminology can occur. It is important to make it clear on which face of glazing films are to be attached, the following is offered for guidance:

Terminology relates to a person entering a controlled area from the unsecure to secure side.

1) Each booth has an outer and inner door
2) Each door has internal and external face
3) Each film has an adhesive side which is applied to the door. This adhesive may be on the 'front' or 'back' of the film.



In practice a 25mm vertical 'Vision-gap' should be provided on outer doors to allow a person entering to see if the booth is occupied. This is not required on inner doors.

General conclusions

Measures can be applied to a range of different scenarios. A key consideration, which must be drawn from an OR for each situation, is how important it will be to retain outward looking visibility. For Guardroom scenarios this may be a critical requirement while for offices the only requirement may be to restrict the ability to gather information by viewing from outside. There is no question that security enhancements are provided by these measures, but there is no single 'silver-bullet' which will address all concerns.

- For viewing out with obscurity looking in, the preferred solution is to use a Privacy Film, However screen printed films may offer a solution if the internal reflections in the room can be controlled. With screen printed films the ability to view out was enhanced by printing the internal face black. However it is noted that this may produce an 'oppressive' atmosphere for staff compared with the lighter coloured finish, whereas a lighter internal face will reduce the visibility out.

- For applications where viewing out is not a critical issue either of the electrically controlled glazing solutions could be considered as well as the Privacy Film. An advantage is that control of the internal lighting is less of an issue.

- The ability to observe into a room is linked directly to the observation distance. For this reason, where it is within the control of the user, potential observers should be restricted from approaching the windows being protected. Measures should be taken to 'stand-off' any potential intruders from the vulnerable windows. The minimum stand-off distance to be aimed for should not be less than 10 metres.

- The outer face of the building should be illuminated. The absolute illumination level has been shown not to be critical, more important is the respective contrast between the outer face of the window (reflective value of the film) against the target being viewed inside the room.

- To maximise the performance of window films the external lighting should be sited such that light is not directed into the building. The levels need not be 'high'; a guide level of 100 Lux vertical Illuminance on the face of the building is suggested. At some locations environmental issues may be a factor, guidance on these is contained in the CPNI Security Lighting Guide.

- The lighting within the protected building should be set as low as commensurate with the staff duties to be carried out. In particular the ratio of internal to external lighting should be maximised. It may be appropriate to reduce internal lighting levels after dark. The internal lighting should be provided by reduced glare luminaires to minimise internal reflections from the inner-face of the windows which would reduce the ability to view out.

- Consideration should be given to 'bomb-blast' requirements, ensuring that any vision control enhancement does not affect existing blast measures.