

Human Factors Engineering
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Lecture - 23
Methods to Reduce Glare/Reflection on Screen

Dear students, during this week we are discussing a different issue related to ergonomic design of computer workstation.

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Ergonomic Design of Computer Workstation

✓ **Methods to Reduce Glare/Reflections on Screens**

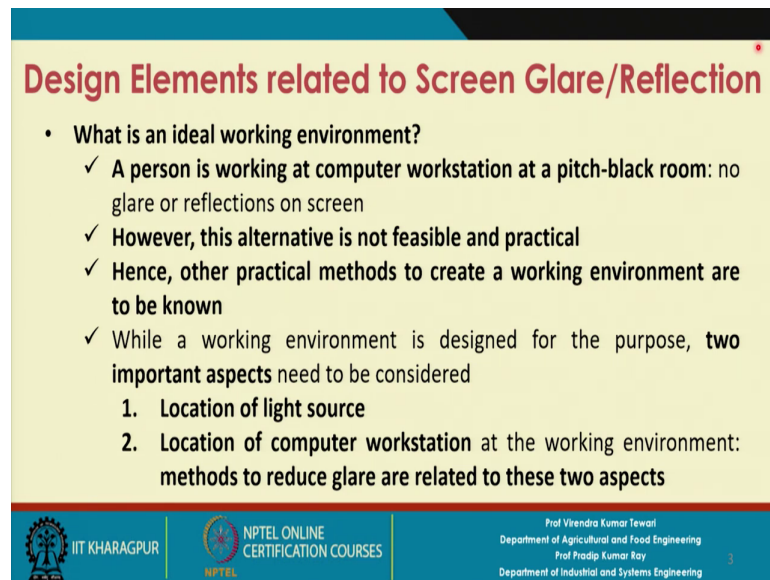
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Now, in the first two lecture sessions we have identified several design elements and typical type of computer workstations.



So, once these the design elements are identified we have also discussed in detail that how to determine the specifications of all these the design elements. Now during this lecture session we will be discussing one important topic called the Methods to Reduce Glare or the Reflection on the screens on the computer screens.

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Design Elements related to Screen Glare/Reflection

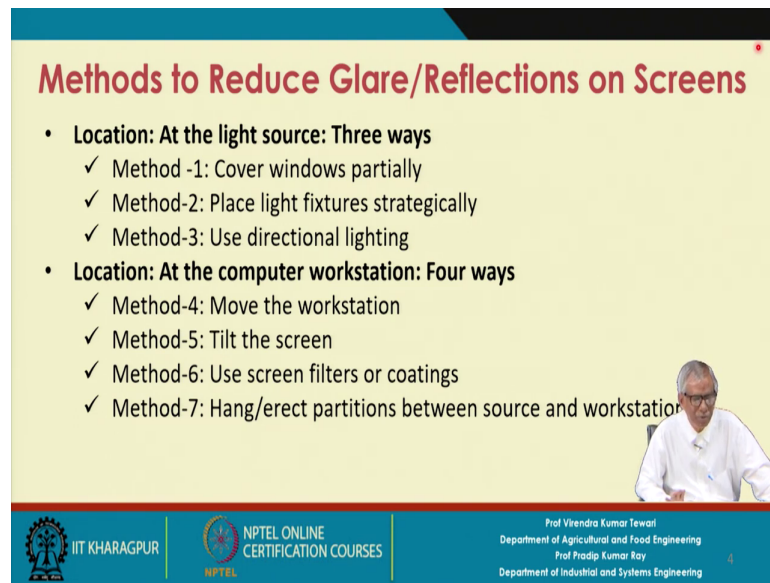
- **What is an ideal working environment?**
 - ✓ **A person is working at computer workstation at a pitch-black room: no glare or reflections on screen**
 - ✓ **However, this alternative is not feasible and practical**
 - ✓ **Hence, other practical methods to create a working environment are to be known**
 - ✓ **While a working environment is designed for the purpose, two important aspects need to be considered**
 - 1. Location of light source**
 - 2. Location of computer workstation at the working environment: methods to reduce glare are related to these two aspects**

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Before I start discussing the methods to reduce these glares or reflections on the computer screens, let us discuss what is ideal working environment.

A person is working at computer workstation at a pitch-black room there will be no glare there will be no reflection on the screen. However, this alternative is not feasible and practical. Hence, other practical methods to create a working environment are to be known. While a working environment is designed for the purpose, two important aspects need to be considered: A. Location of light source. B. Location of computer workstation at the working environment. Methods to reduce glare are related to these two aspects.

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Methods to Reduce Glare/Reflections on Screens

- **Location: At the light source: Three ways**
 - ✓ Method -1: Cover windows partially
 - ✓ Method-2: Place light fixtures strategically
 - ✓ Method-3: Use directional lighting
- **Location: At the computer workstation: Four ways**
 - ✓ Method-4: Move the workstation
 - ✓ Method-5: Tilt the screen
 - ✓ Method-6: Use screen filters or coatings
 - ✓ Method-7: Hang/erect partitions between source and workstation

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So, the first thing is you must know is the location of the light source and the 2nd important thing you must remember that is where is the location of your computer workstation?

When the Location is at the light source, there are Three ways

Method -1: Cover windows partially

Method-2: Place light fixtures strategically

Method-3: Use directional lighting

Location is at the computer workstation, there are Four ways

Method-4: Move the workstation

Method-5: Tilt the screen

Method-6: Use screen filters or coatings

Method-7: Hang/erect partitions between source and workstation

So, altogether you have 7 alternatives or the 7 methods. Now based on the situation you have to verify.

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Methods to Reduce Glare/Reflections on Screens

- **Method-1**
 - ✓ Cover windows completely or partially using draperies, vertical louvers, horizontal louvers, and/or gray plastic film
 - ✓ Vertical louvre is preferred to horizontal louvre
 - ✓ Windows can be covered with gray sheet of plastic (neutral density film): reducing transmission of light from outside
- **Method-2**
 - ✓ First, light fixtures (luminaire) with a light angle of 100-110° are to be used
 - ✓ Secondly, location of operator workstation is to be decided based on prevention of both direct glare and reflected glare on computer screen

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So out of these 7 methods, you are going to implement most practical one.

Now, let us discuss about each method.

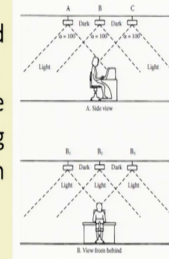
Method-1- Cover windows completely or partially using draperies, vertical louvers, horizontal louvers, and/or gray plastic film. Vertical louvre is preferred to horizontal louvre. Windows can be covered with gray sheet of plastic (neutral density film): reducing transmission of light from outside

Method-2- First, light fixtures (luminaire) with a light angle of 100-110° are to be used. Secondly, location of operator workstation is to be decided based on prevention of both direct glare and reflected glare on computer screen.

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Methods to Reduce Glare/Reflections on Screens

- In a working environment, a number of computer workstations are to be placed on the floor, and in respect of their location, a number of luminaires are placed at the ceiling of the roof in both longitudinal and transverse directions
- **Example-1: Side view:** from luminaire-A, no reflected glare; and from luminaire-C, no direct glare
- **Example-2: Back view:** location of B1 and B3 are better than location of B2 (causing veiling reflection):Luminaires should be placed to side of an operator, not at front or back



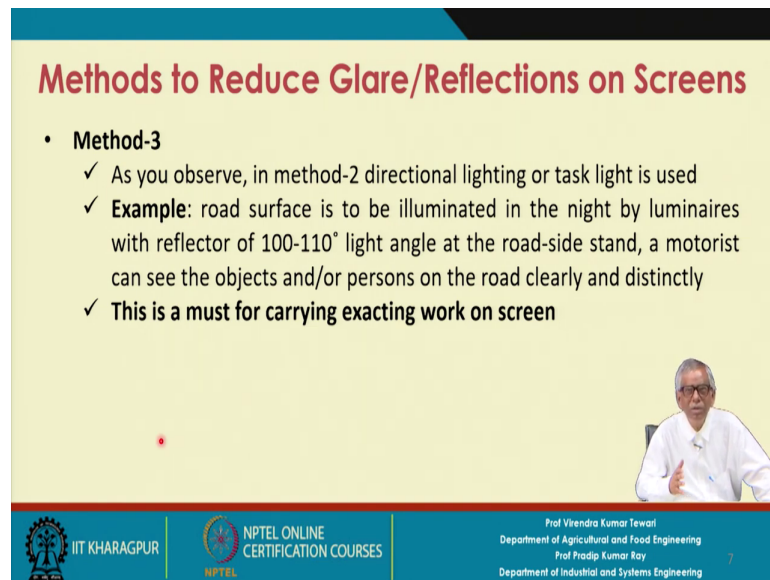
So, in a working environment a number of computer workstations are to be placed on the floor. That is a is typical working environment not only you are using the computer there are other persons they are your colleagues. So, they are also using computers.

So, a number of computer workstations you come across and in and each computer has its own location. So, in respect of their location a number of luminaires are placed at the ceiling of the roof, in both longitudinal and transverse directions.

Example-1: Side view: from luminaire-A, no reflected glare; and from luminaire-C, no direct glare

Example-2: Back view: location of B1 and B3 are better than location of B2 (causing veiling reflection):Luminaires should be placed to side of an operator, not at front or back

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Methods to Reduce Glare/Reflections on Screens

- **Method-3**
 - ✓ As you observe, in method-2 directional lighting or task light is used
 - ✓ **Example:** road surface is to be illuminated in the night by luminaires with reflector of 100-110° light angle at the road-side stand, a motorist can see the objects and/or persons on the road clearly and distinctly
 - ✓ **This is a must for carrying exacting work on screen**

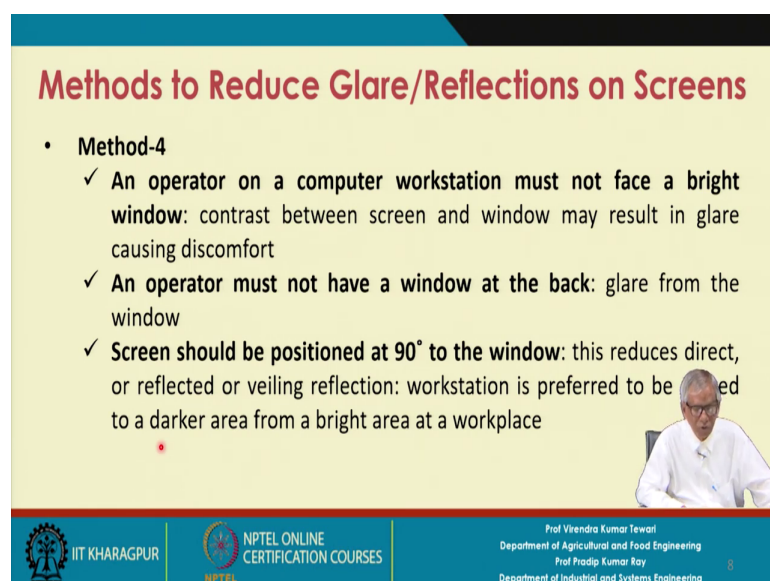
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This is a must for carrying exacting work on screen.

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Methods to Reduce Glare/Reflections on Screens

- **Method-4**
 - ✓ **An operator on a computer workstation must not face a bright window:** contrast between screen and window may result in glare causing discomfort
 - ✓ **An operator must not have a window at the back:** glare from the window
 - ✓ **Screen should be positioned at 90° to the window:** this reduces direct, or reflected or veiling reflection: workstation is preferred to be placed to a darker area from a bright area at a workplace

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Method-4- An operator on a computer workstation must not face a bright window: contrast between screen and window may result in glare causing discomfort

An operator must not have a window at the back: glare from the window

Screen should be positioned at 90° to the window: this reduces direct, or reflected or veiling reflection: workstation is preferred to be moved to a darker area from a bright area at a workplace

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Methods to Reduce Glare/Reflections on Screens

- **Method-5**
 - ✓ The angle of screen is to be changed to avoid reflections from overhead luminaires: you look at the desired characters only
 - ✓ **Make sure that angle of screen can be changed for a wide range**
- **Method-6**

The slide contains two diagrams illustrating Method-6. The left diagram shows a VDT (Visual Display Terminal) with 'Light emitted by phosphor' and 'Ambient Light' rays. The right diagram shows a VDT with a 'Filter' on the screen, 'Light emitted by phosphor' rays, and 'Ambient Light' rays.

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Method 5- it is related to location of the computer workstation. So, the angle of screen is to be changed to avoid reflections from overhead luminaires that you always can do that means option is tilting the screen.

In many computer workstations you have this alternative and make sure that the angle of screen can be changed for a wide range.

Method 6: it is related to using different kinds of the filters. So, the term we use like computer workstation visual display terminal. So, here in the first figure you will find that the computer does not have any filter.

So, light emitted by phosphor screen is the ambient light and there will be reflections. So obviously, there will be luminance or the contrast ratio.

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Methods to Reduce Glare/Reflections on Screens

- **Method-6**
 - ✓ Filters can be used to increase contrast ratio (luminance contrast) between screen characters and screen background
 - ✓ **Types of filters:** neutral density filter, colour filter, polarized filters, etc
 - ✓ **Using a filter, incoming light is illuminated twice:** once to the screen, and another from the screen
 - ✓ **Quarter wavelength filter:** light enters filter, reflections from first and third surface: difference in travelled distance between the reflections is one-half wavelength: two reflections in counter phase and no reflected light: this filter can be mounted on top

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Method-6: Filters can be used to increase contrast ratio (luminance contrast) between screen characters and screen background.

Types of filters are neutral density filter, colour filter, polarized filters, etc. Using a filter, incoming light is illuminated twice, once to the screen, and another from the screen.

Quarter wavelength filter: light enters filter, reflections from first and third surface: difference in travelled distance between the reflections is one-half wavelength. The two reflections in counter phase and no reflected light, this filter can be mounted on top.

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Methods to Reduce Glare/Reflections on Screens

- **Method-7**
 - ✓ Hang partition from ceiling or standing from floor
 - ✓ Illumination from light is blocked
 - ✓ This method can be used in an open environment like at any workplace, manufacturing plant, etc.

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Method 7: it is hanging partition from ceiling or standing from the floor, this observes in many workplaces. in office environment these days you will find that many persons are working and the different the cubicles are there. And what you are you can use this partition.

So, illumination from the light is blocked that is the main purpose and this method can be used in an open environment. At any work place always, there could be 2 types of work environment you either closed or the open. This method can be used in an open environment like at any workplace, manufacturing plant, etc.

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Effect of Screen Filter on Contrast Ratio

- Visibility depends upon contrast ratio or luminance contrast between screen characters and screen background
- With the screen filter, contrast ratio improves
- There may be a set of numerical problems on this issue

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Now, so if the contrast ratio is more acceptable. The main advantage is their visibility quality will improve. So, the visibility depends upon contrast ratio or the luminance contrast between screen characters and the screen background. Like say when you read a book, usually there are the black characters and the background is white. So, what is the contrast ratio? Contrast ratio is 1:40.

Whereas, in general contrast ratio if you read some materials some characters on the screen, usually the contrast ratio may be as low as 1 is to 8. So, this is to be increased say can you not say increase it from say 1 is to 8 to 1 is to 16. So, with the screen filter contrast ratio improves there may be a set of numerical problems on this issue.

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List of Reference Textbooks

1. Sanders, M. S. and McCormick, E. J., Human Factors in Engineering and Design, McGraw-Hill, Sixth Edition
2. Bridger, R. S., Introduction to Ergonomics, Taylor and Francis Group, Third Edition
3. Helander M, A Guide to Human factors and Ergonomics, Taylor and Francis Group, Second Edition

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And one of the main advantages of reducing glare on the screen that is your performance on the tasks that you carry out with the help of the computer. Certain tasks you carry out and so it will help you, the contrast ratio will be increased and there will be no glare and your performance will be better. Like say suppose your job is writing program or programmers jobs. So, while you write this program obviously, you will need very clear visibility with a software. So, if there is a glare or the reflection on the screen; obviously, you start working very slowly.

So, interface design is a challenging assignment and whenever you talk about say ergonomic design our focus is interface. And in respect of ergonomic design of computer workstation, our main focus is how to design that human computer interface. So, and now this is a very important area.

So, it all depends on the kinds of the software you use, the kinds of the hardware you use, the kinds of problems you are dealing with or the kinds of task you use and many a time your performance whether you are working with the help of computer or you do it manually it depends on what sort of tasks you are carrying out. And so if you carry out one particular analysis it is called task analysis.

So, if you carry out task analysis there are certain procedures. That means, certain requirements from the users perspective, certain requirements from the computer perspectives, certain requirements you have from the job perspective.

So, when you define this interface whether there is a perfect balance among this. So, if there is a balance. So, you work very smoothly on the computer and you feel very happy. Now another important point is there is a concept called individual difference and while you go for ergonomic design, we must recognize the individual difference.

So, the challenge is that for person this computer workstation is perfectly designed, there is no guarantee that for another person be the same. The computer workstation with same sort of tasks being carried out. So, the design may not be perfect. So, what is most important is that, why do not you introduce the concept of flexibility. That means, you must be given enough opportunities so that you can change your interact with your computer to carry out a particular task in your own way. So, for that the many kinds of features you must have in the computer. Suppose we have referred to some 10 to 12 or 10 to 13 the design elements and all these design elements, definitely are all essential. You have to determine the specifications of all these designs. And you will find in the specification there is a range. That means it fits to not only for one particular individual for a group of individuals.

That means what we are saying this ergonomic design of computer workstation is not only made for just one person, but it is to be made for the different persons is it group of persons. That means, designed for everyone, but first you try to check the anthropometry of a group of persons, relevant anthropometry and then you check whether this design is matching with a group as a requirement or not.

There will be certain specifications in the work place that you have to decide. Similarly, like directional lighting. In a particular case you have to decide on, what will be the angle focusing what will be the distance.

Like similarly for all others the methods like say method 6, method 5 and there is a gap between the computer screen and the filter. So, that you have to decide. So, these are the minor details, because as a designer you must go on to minor details. And in majority of the cases, you go for the specification range.

The design should be such that it can address different kinds of problems. So, one such problem is the glarer or reflection and by taking all these approaches or the methods we are going to implement. You try to the minimize the glare or reflections on the computer screen.