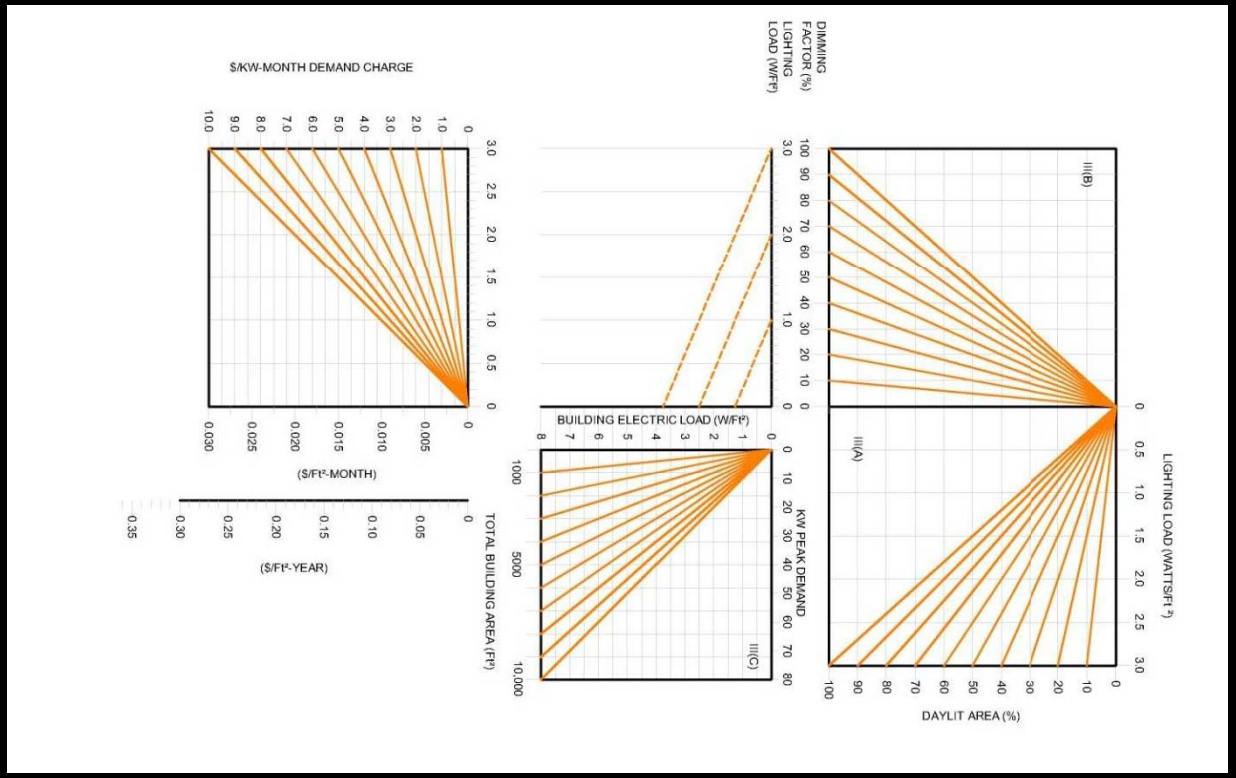
DAYLIGHTING NOMOGRAPHS REVISITED

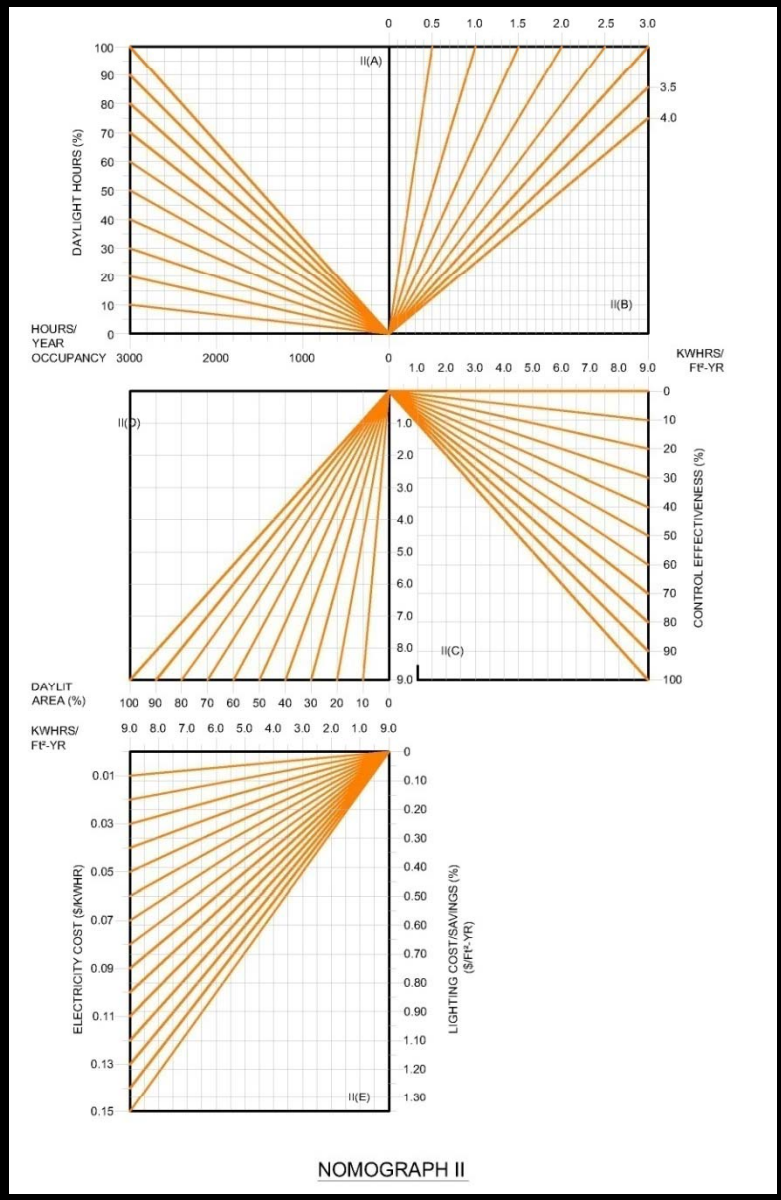
RADIANCE WORKSHOP, October 23 2009

ROHIT MANUDHANE | CHRISTOPH REINHART
Harvard Graduate School of Design

LBL DAYLIGHTING NOMOGRAPHS

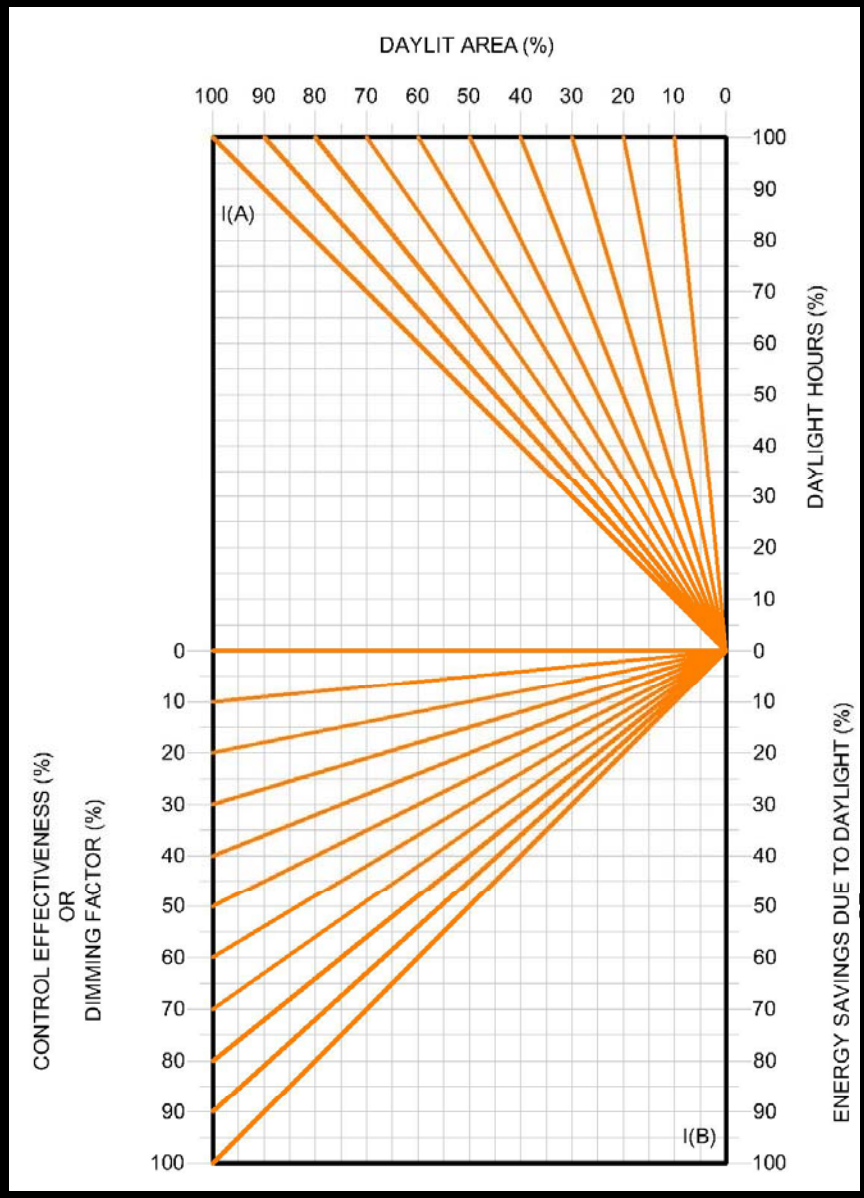
- Originated from the 1984 paper titled LBL Daylighting Nomographs by Selkowitz and Gabel
- Validated using DOE 2 measurements





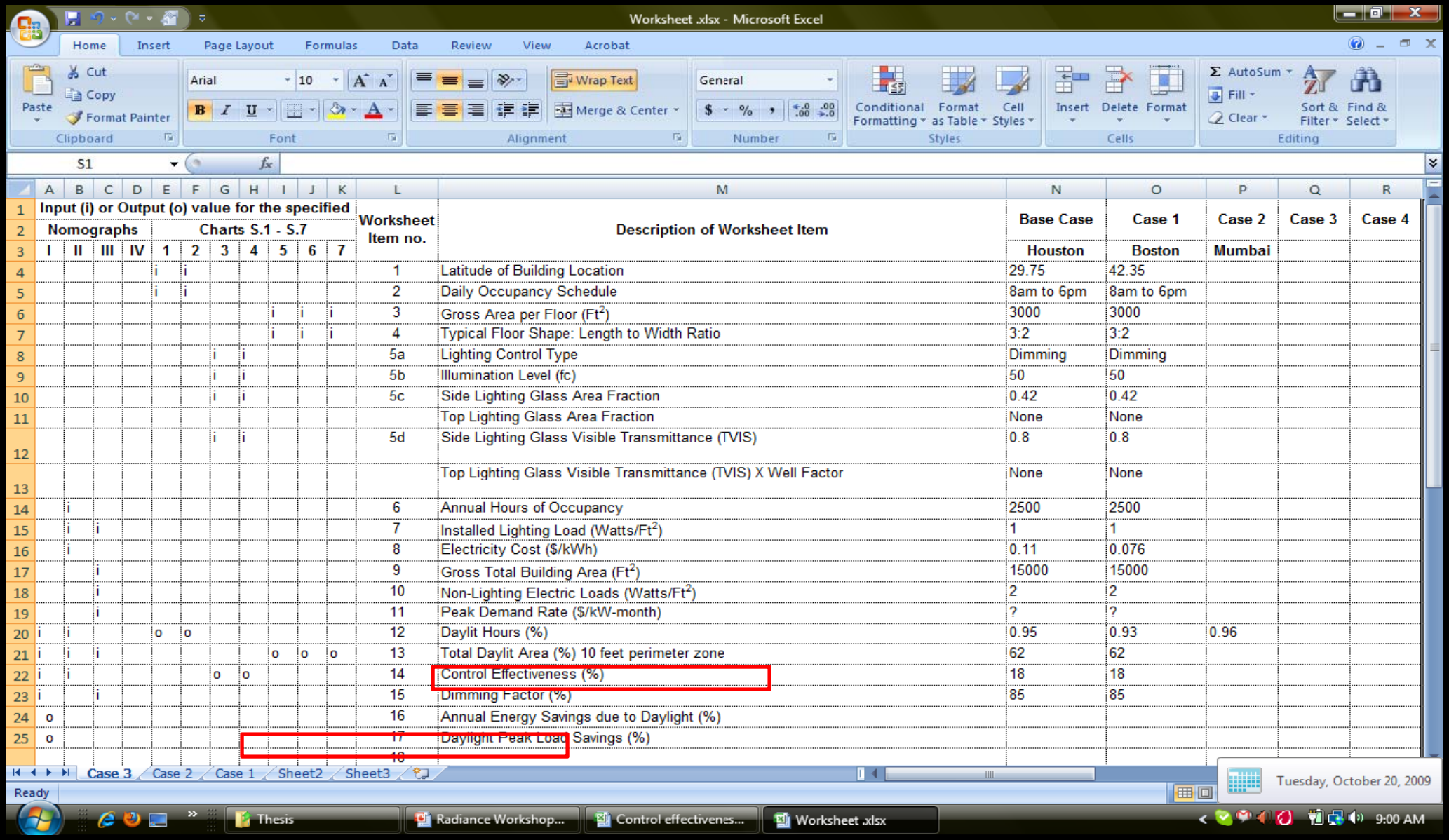
USING THE NOMOGRAPHS

- Determine potential impact of daylighting in a commercial building.
- Flexibility in:
  - Latitude of location
  - Occupancy hours and schedule
  - Total building floor area
  - Daylight floor area
  - Visible Light transmittance of glazing
  - Glazing area
  - Choice of dimming or one step controls
  - Maximum dimming factor



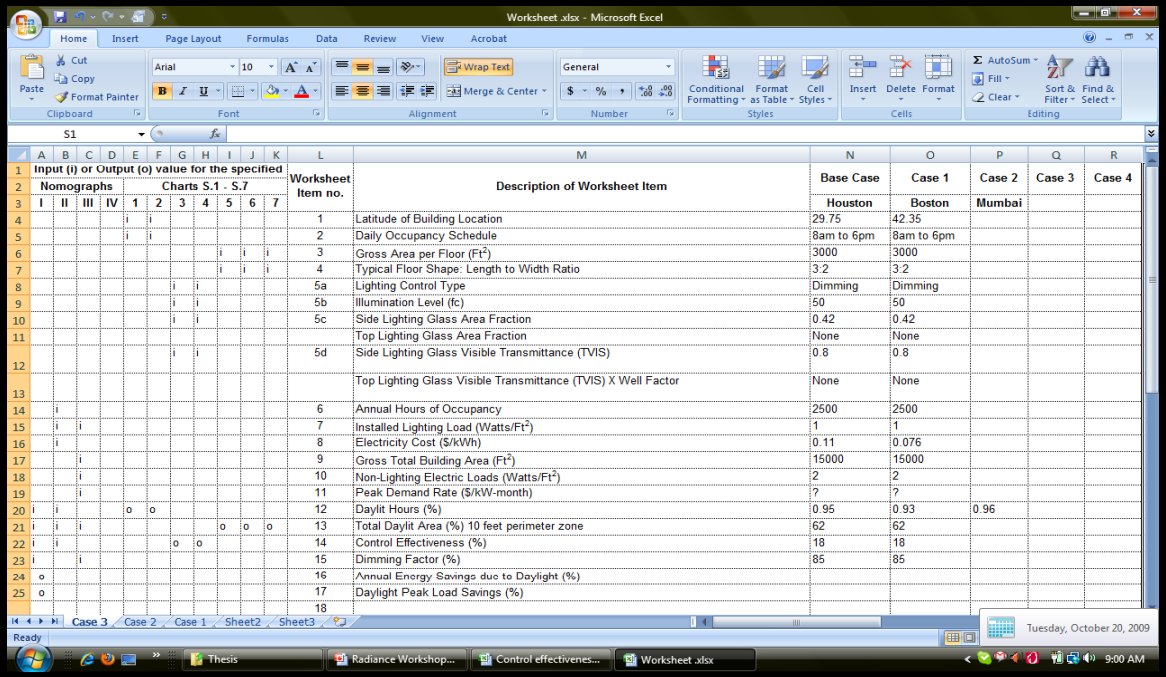
Harvard Graduate School of Design

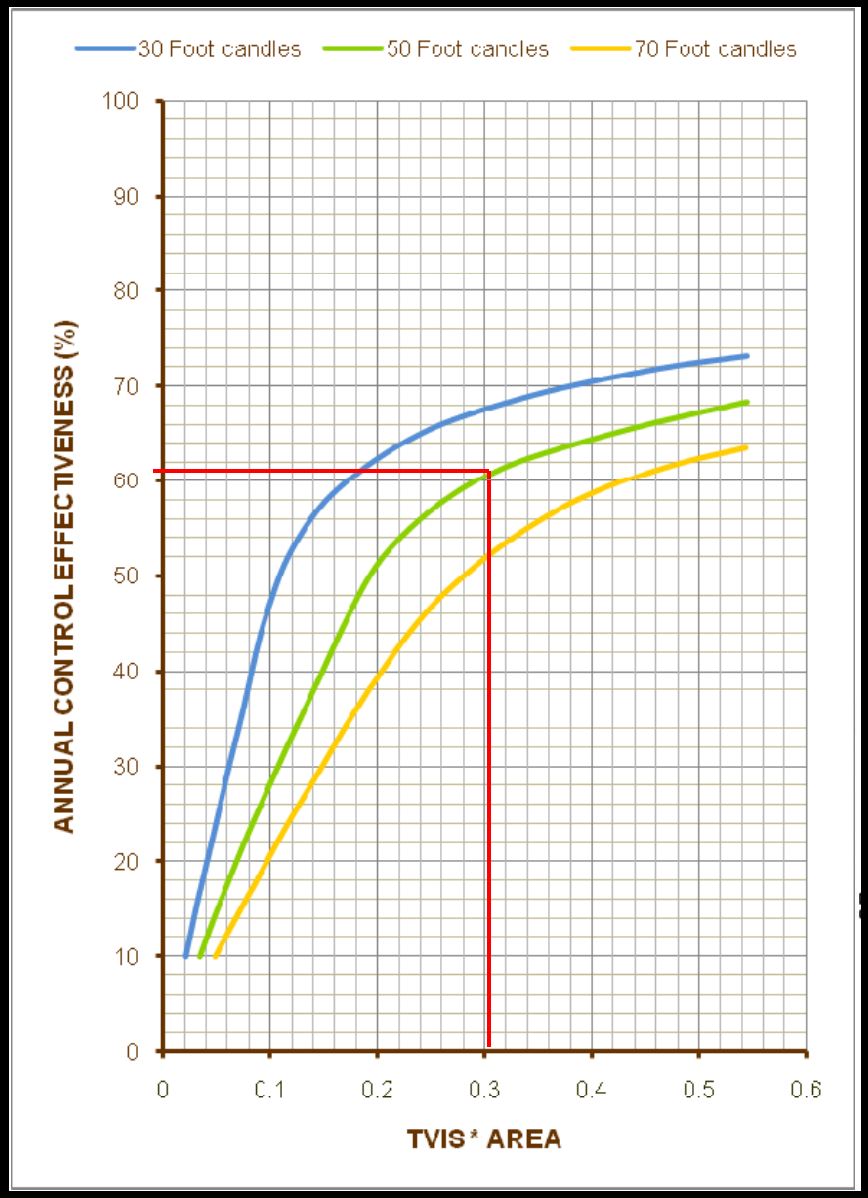
USING THE NOMOGRAPHS



USING THE NOMOGRAPHS

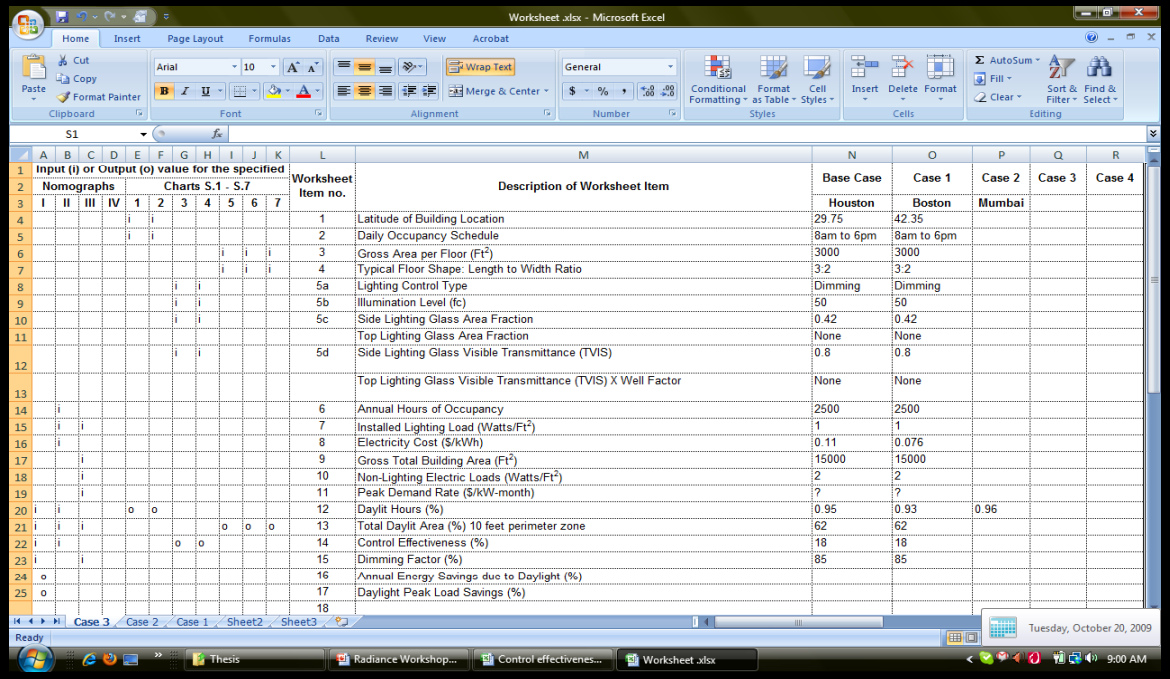
- Daylight hours: 95%
- Daylit area: 62%
- Threshold Illumination level: 50 foot candles
- TVIS * Area: 0.3
- Annual Control Effectiveness: 61%

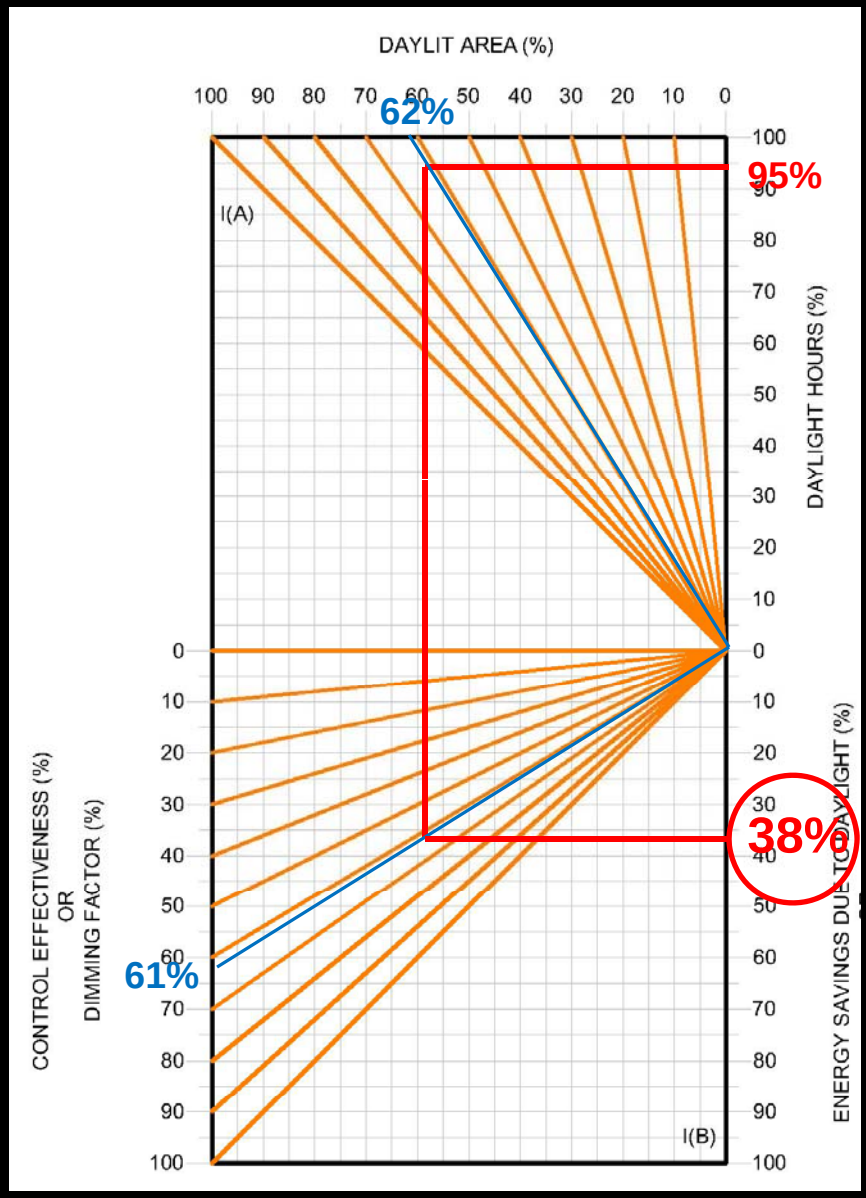




USING THE NOMOGRAPHS

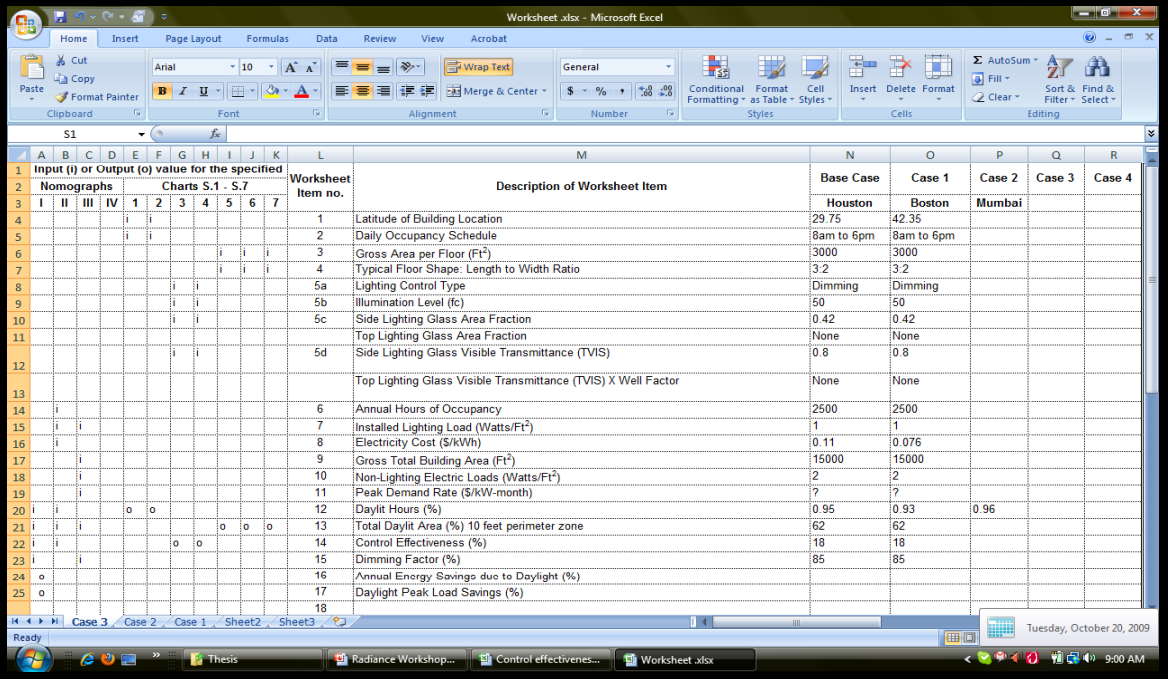
- Daylight hours: 95%
- Daylit area: 62%
- Threshold Illumination level: 50 foot candles
- TVIS * Area: 0.3
- Annual Control Effectiveness: 61%

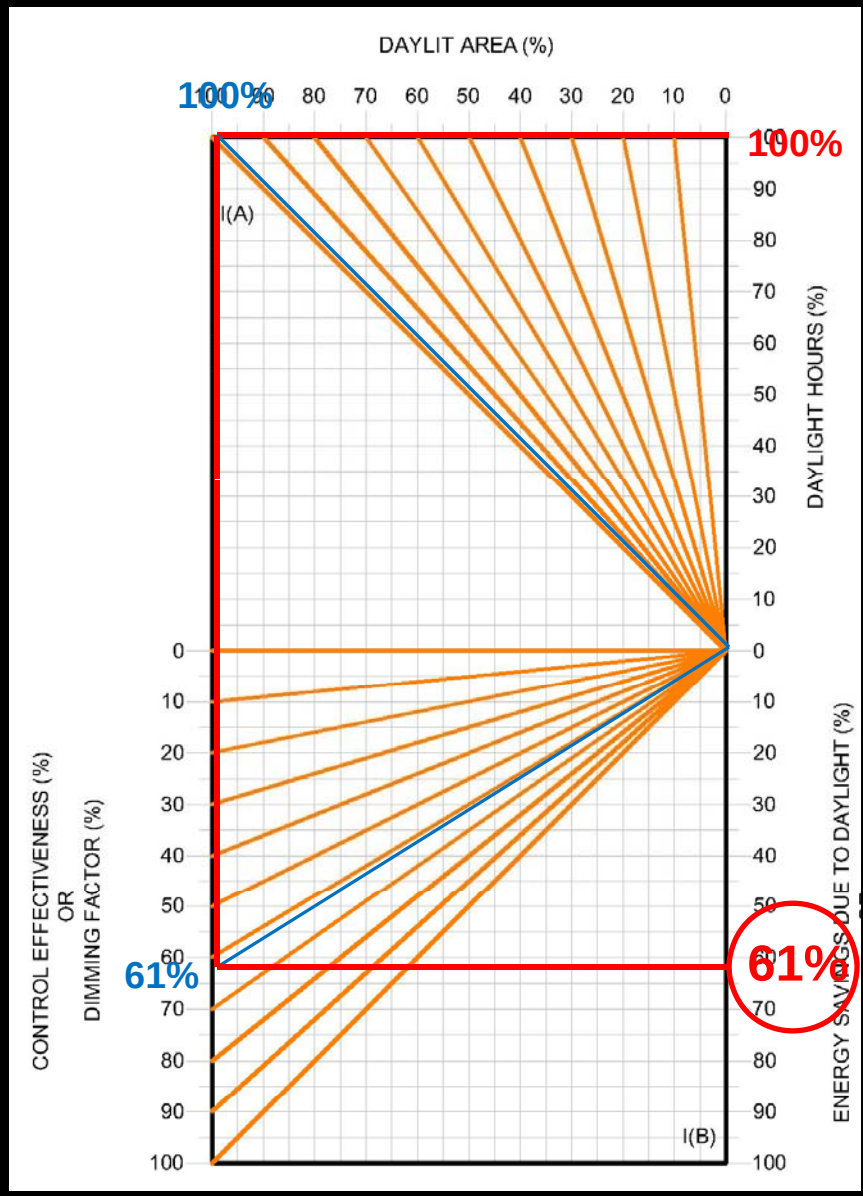




USING THE NOMOGRAPHS

- Daylight hours: 100%
- Daylit area: 100%
- Threshold Illumination level: 50 foot candles
- TVIS * Area: 0.3
- Annual Control Effectiveness: **61%**

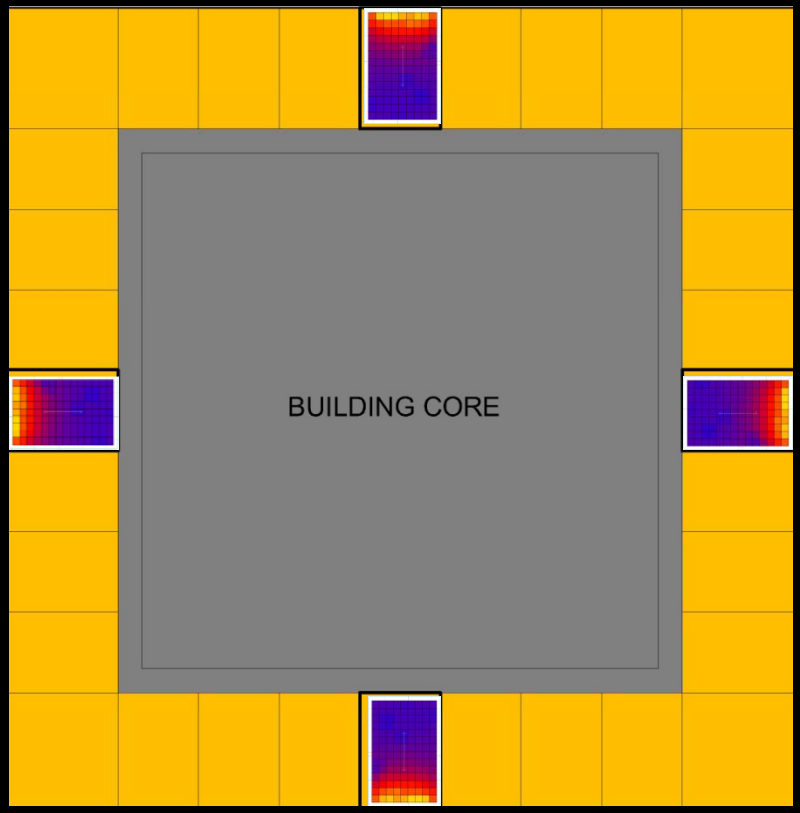


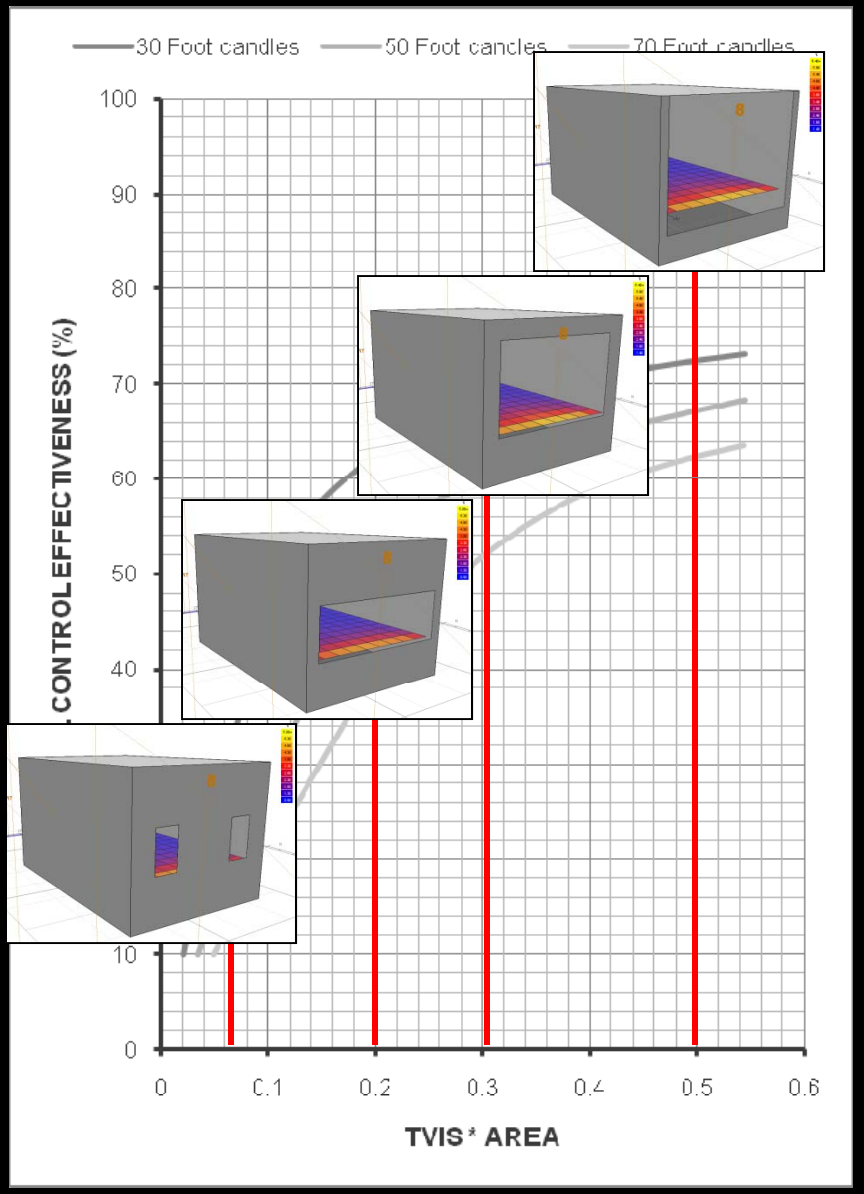


RECREATING NOMOGRAPH RESULTS IN RADIANCE/ DAYSIM

The Nomograph parameters:

- Occupancy hours: 0800 to 1800
- Lighting Power Density: 1W/ sq ft
- No individual lighting controls, no blinds

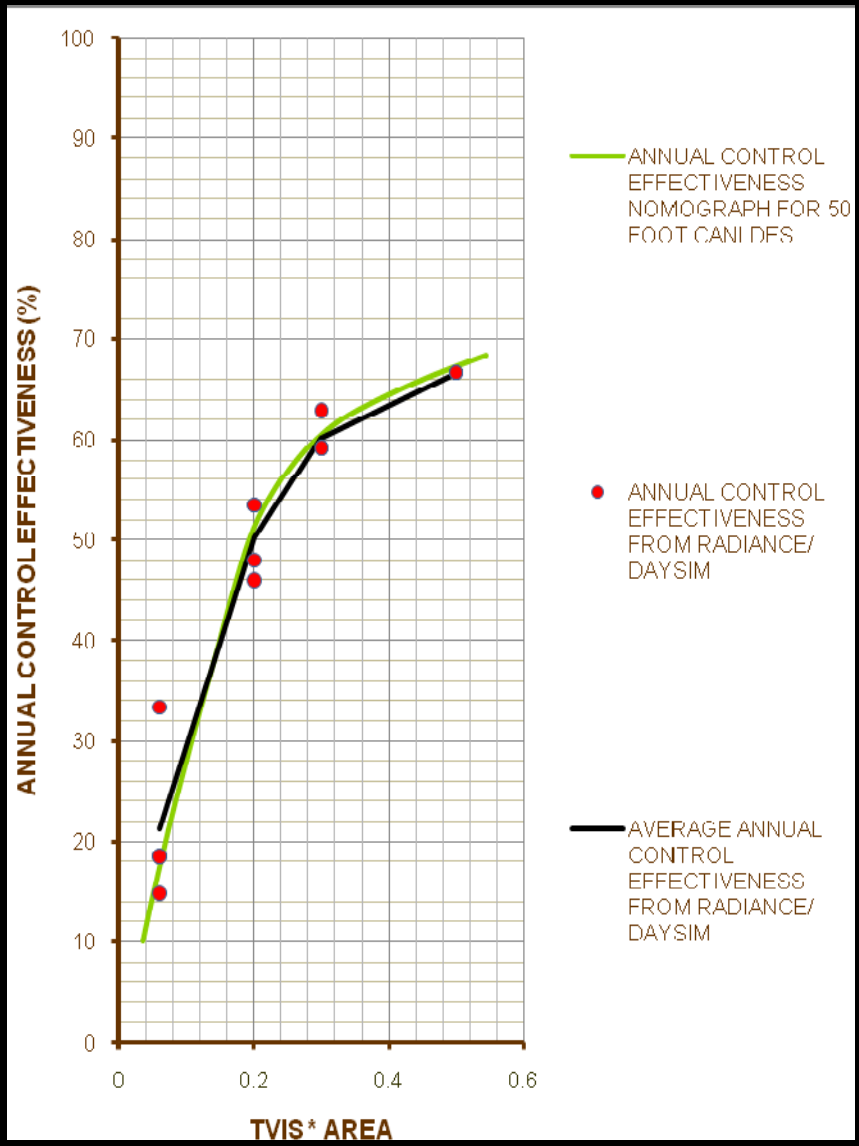




RECREATING NOMOGRAPH RESULTS IN RADIANCE/ DAYSIM

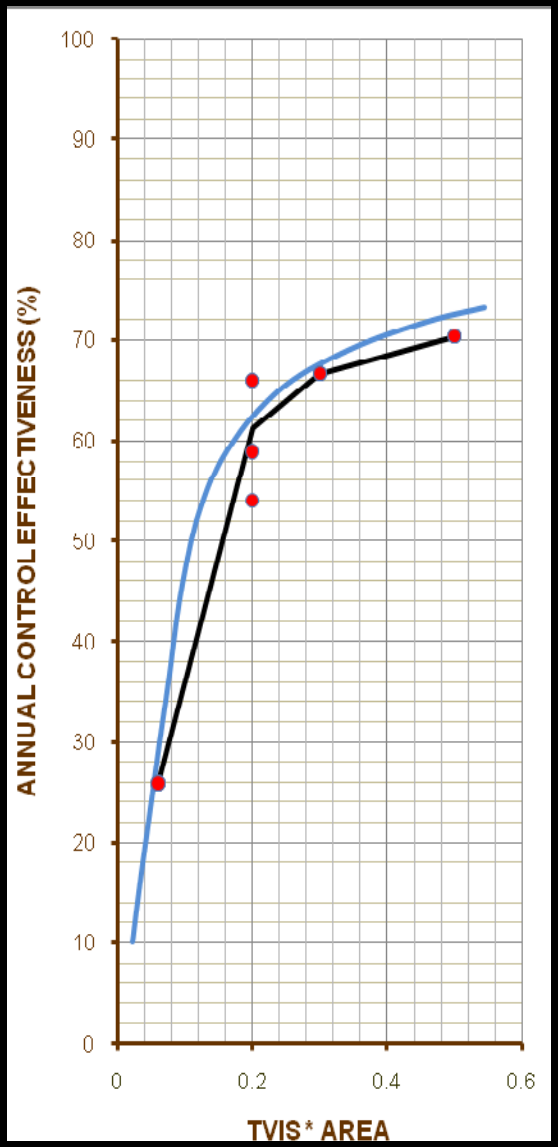
The Nomograph parameters:

- Occupancy hours: 0800 to 1800
- Lighting Power Density: 1W/ sq ft
- Lighting user: No individual controls
- Blind user: No blinds installed
- Threshold Illumination level: 50 foot candles

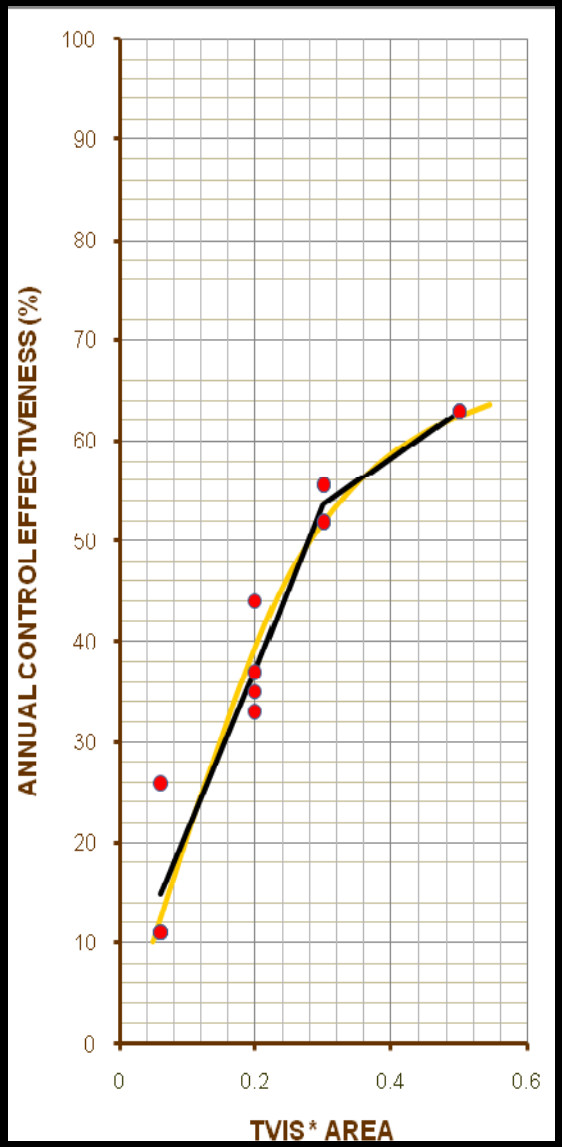


50 foot candles

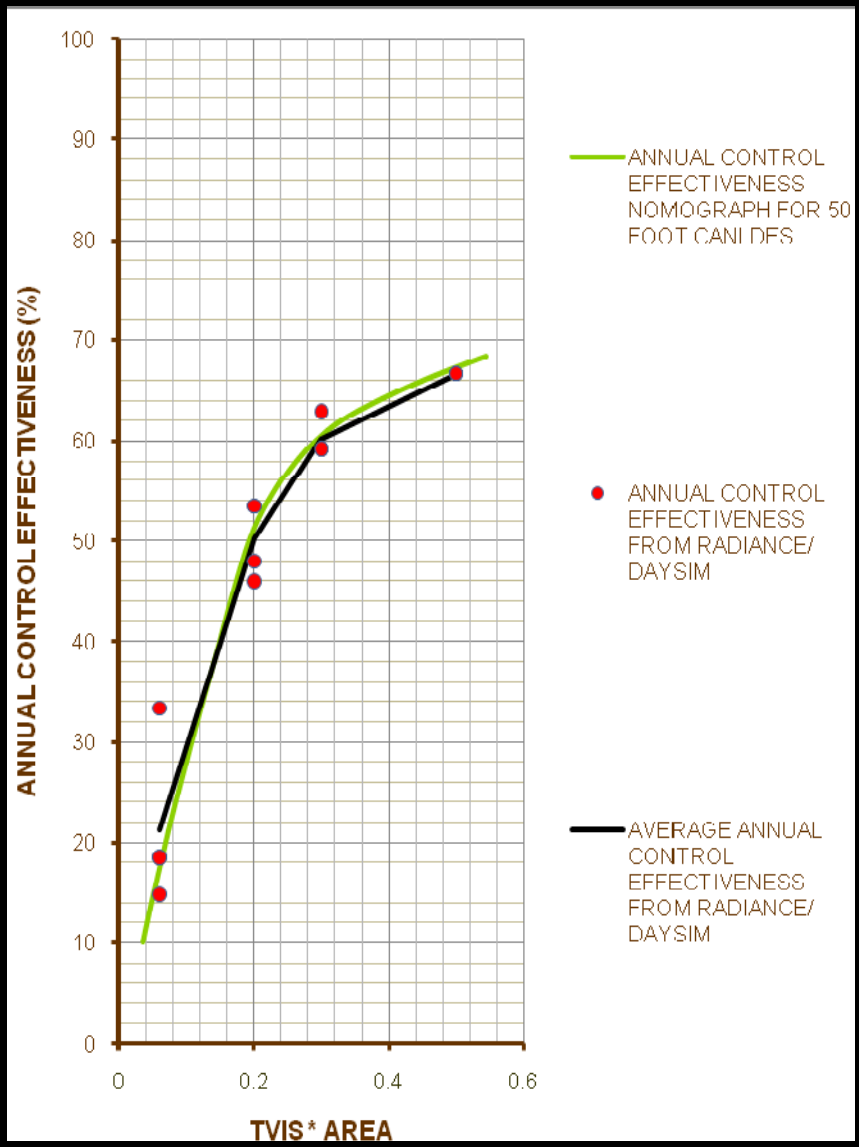
RECREATING NOMOGRAPH RESULTS IN RADIANCE/ DAYSIM



30 foot candles



70 foot candles

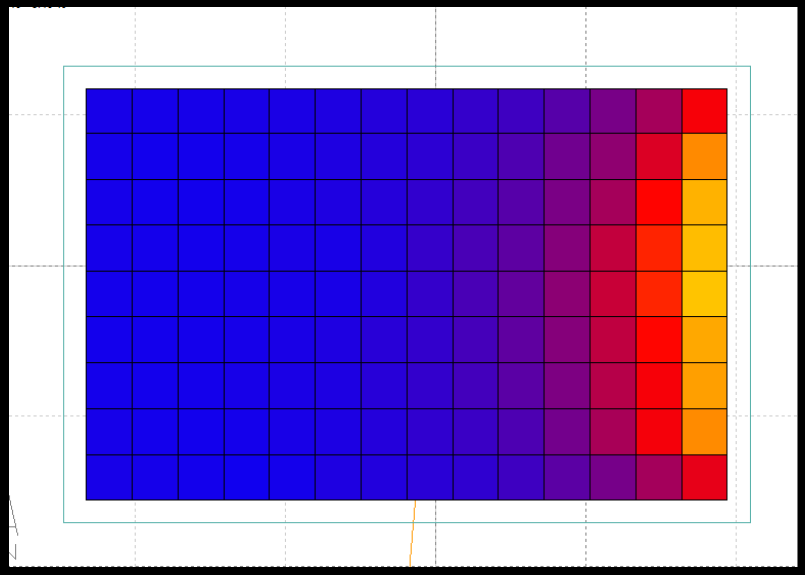


50 foot candles

ENERGY SAVINGS FROM DAYLIGHTING TODAY

The Nomograph parameters (1984):

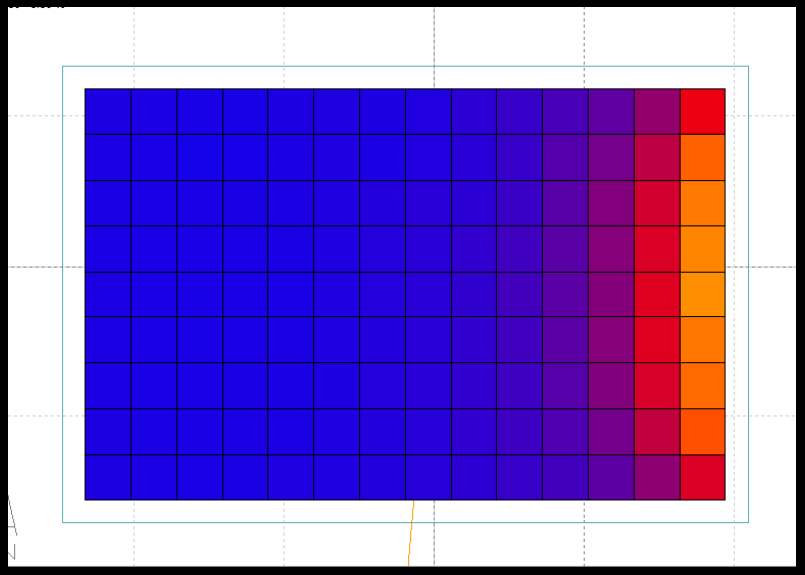
- Lighting user: No individual controls
- Blind user: No blinds installed
- Reference: Lights always on



Daylight Autonomy Analysis with the above parameters

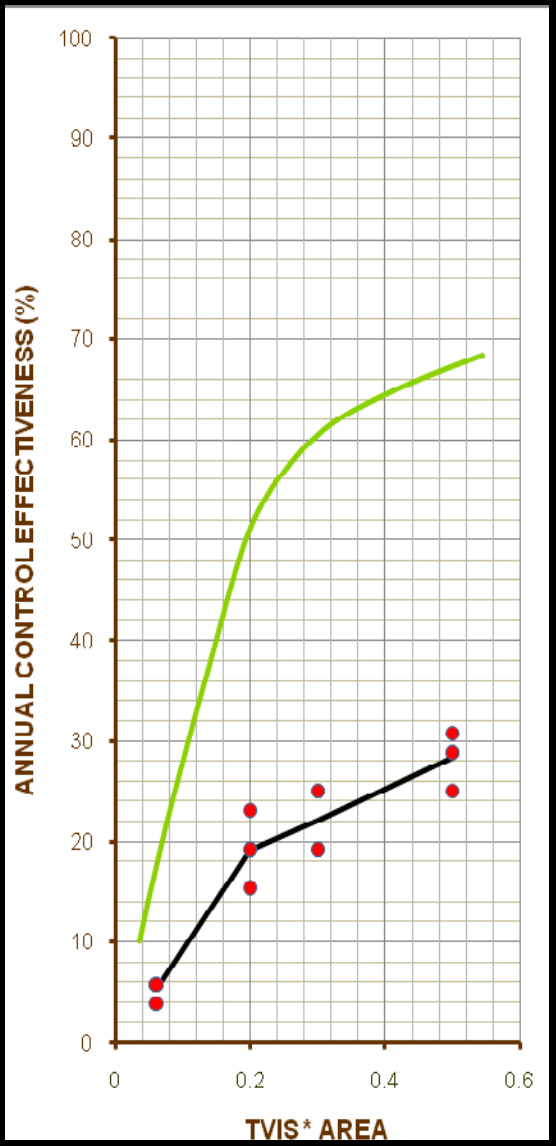
Parameters for practices today:

- Lighting user: Individual controls (Switches)
- Blind user: Blinds (inevitable)
- Lighting controls: Photo sensor controlled dimming system (How efficient?)
- Reference: Lights under individual controls



Daylight Autonomy Analysis with the above parameters

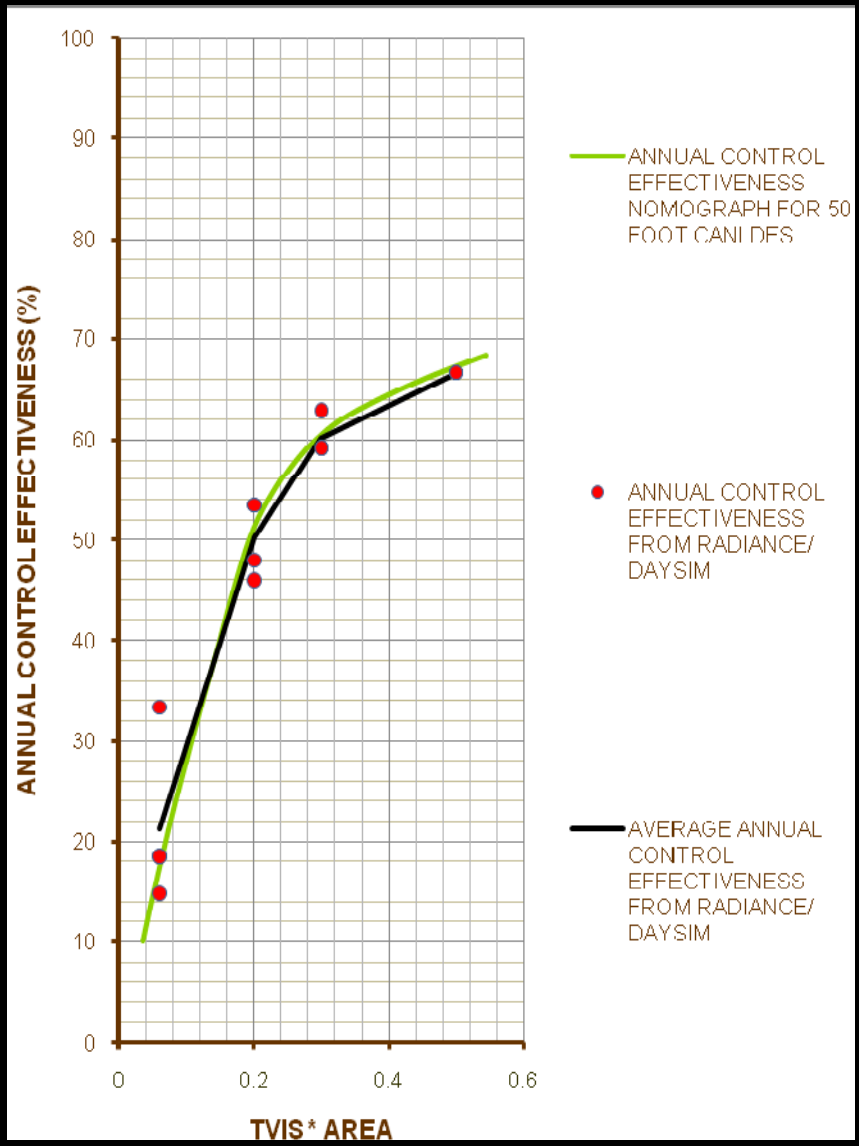
ENERGY SAVINGS DUE TO OCCUPANT BEHAVIOR:



Blinds
Yes
Blind control
Occupant
Lighting system
On/ Off
Lighting control
Average Occupant

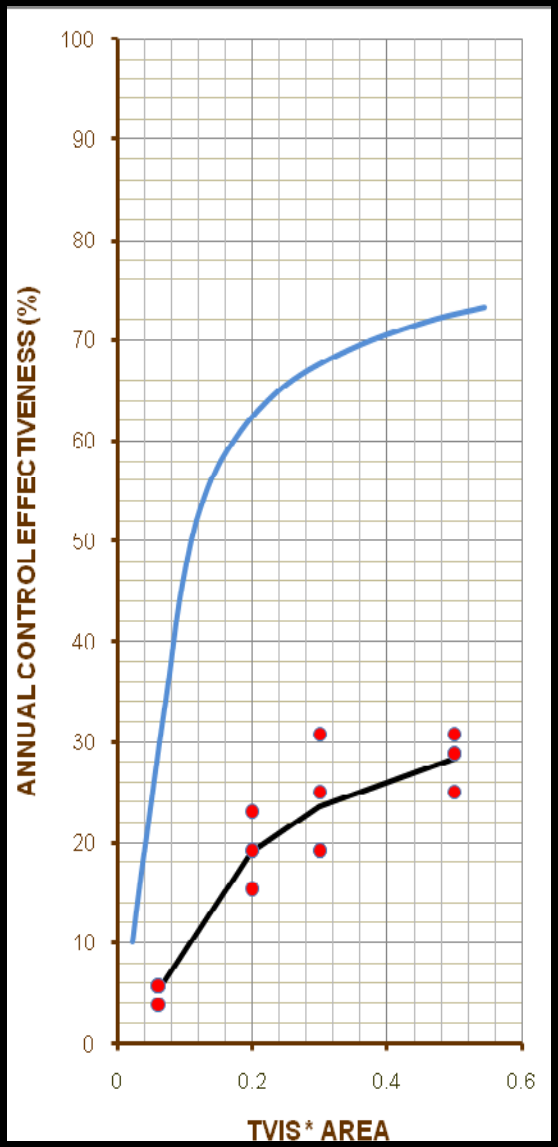
Blinds
No
Blind control
NA
Lighting system
Dimming
Lighting control
None

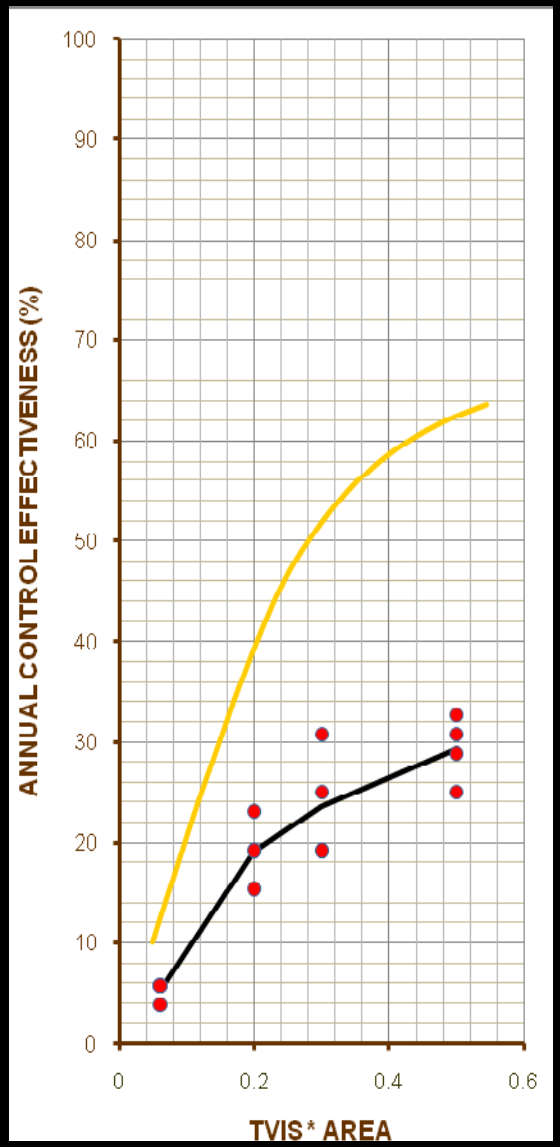
Private office, standard lighting system

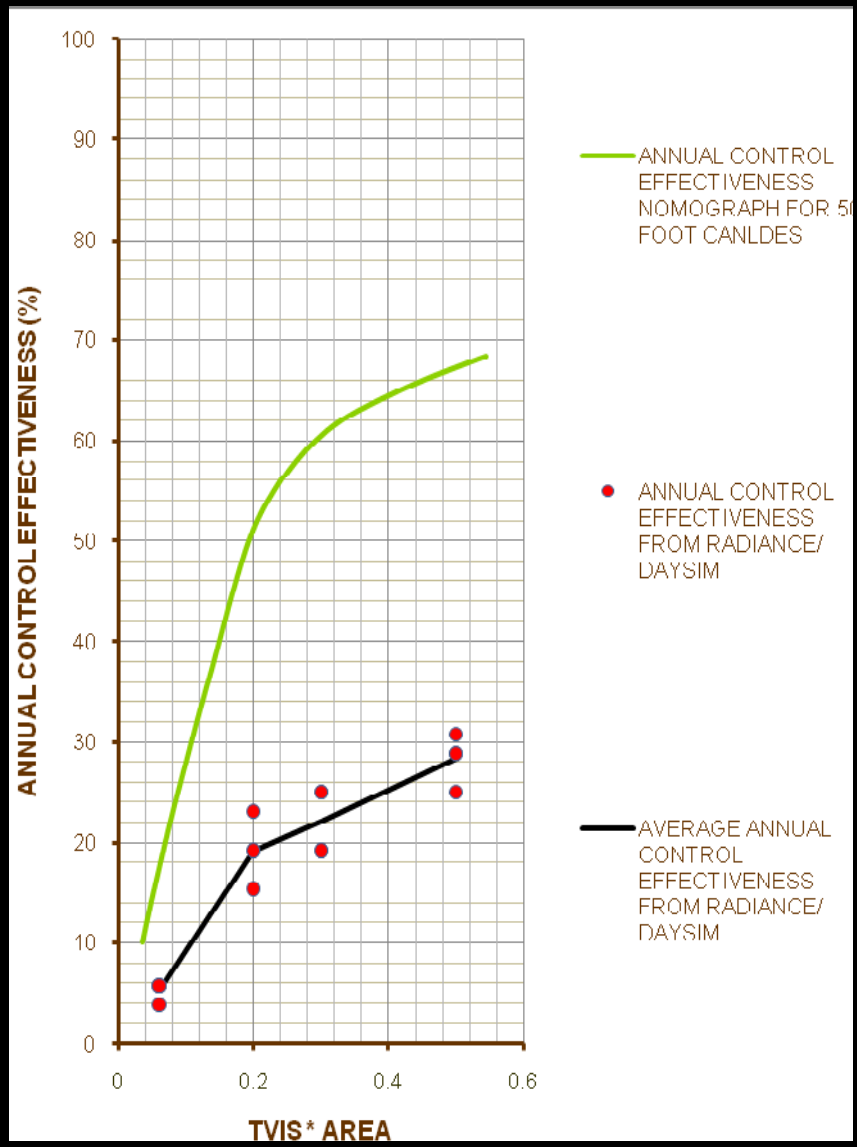


LBL Nomograph conditions

ENERGY SAVINGS DUE TO OCCUPANT BEHAVIOR:

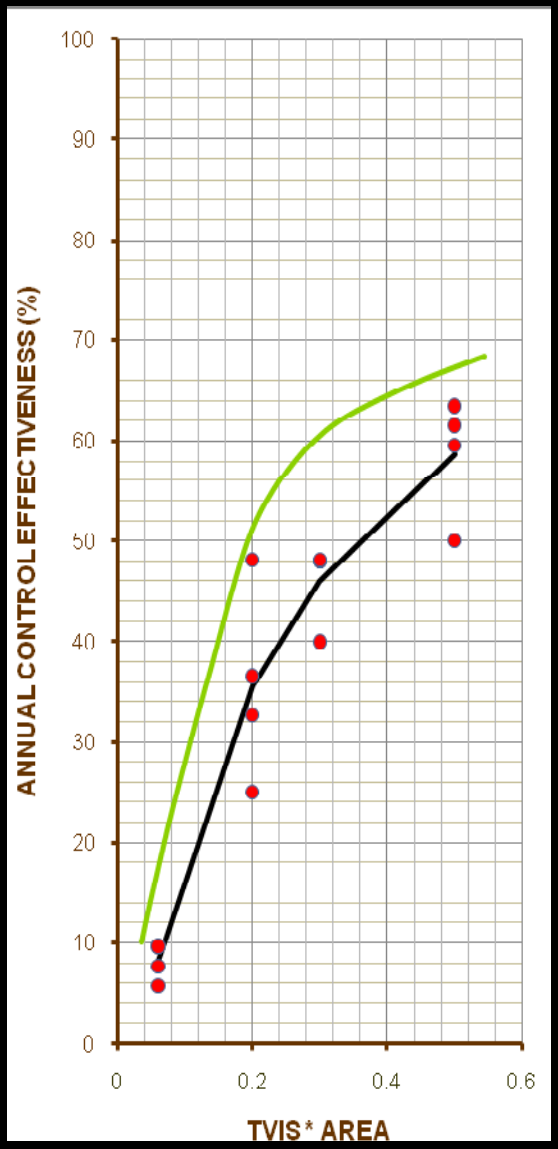






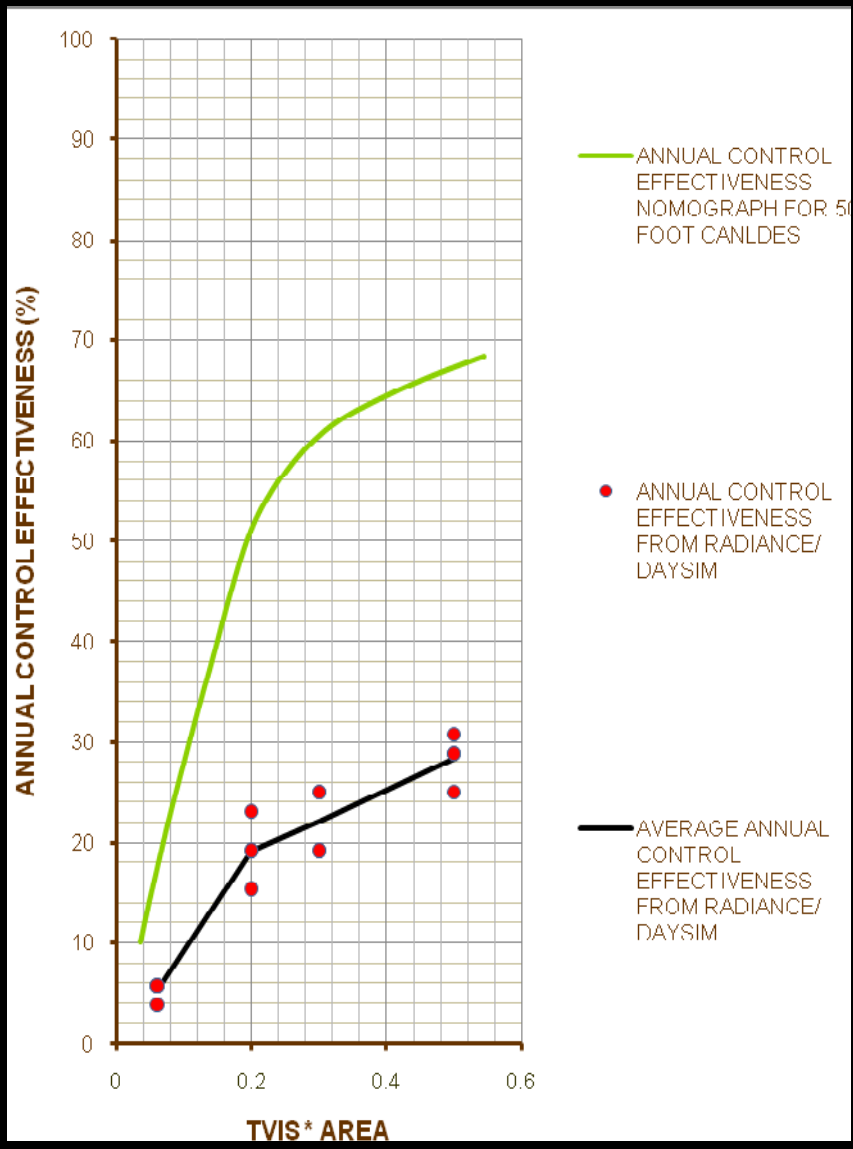
Blinds Yes | **Blind control** Occupant | **Lighting system** On / Off | **Lighting control** Average Occupant

ENERGY SAVINGS DUE TO LIGHTING CONTROL SYSTEMS:



Blinds
Yes
Blind control
Occupant
Lighting system:
Dimming
Lighting control
Average occupant

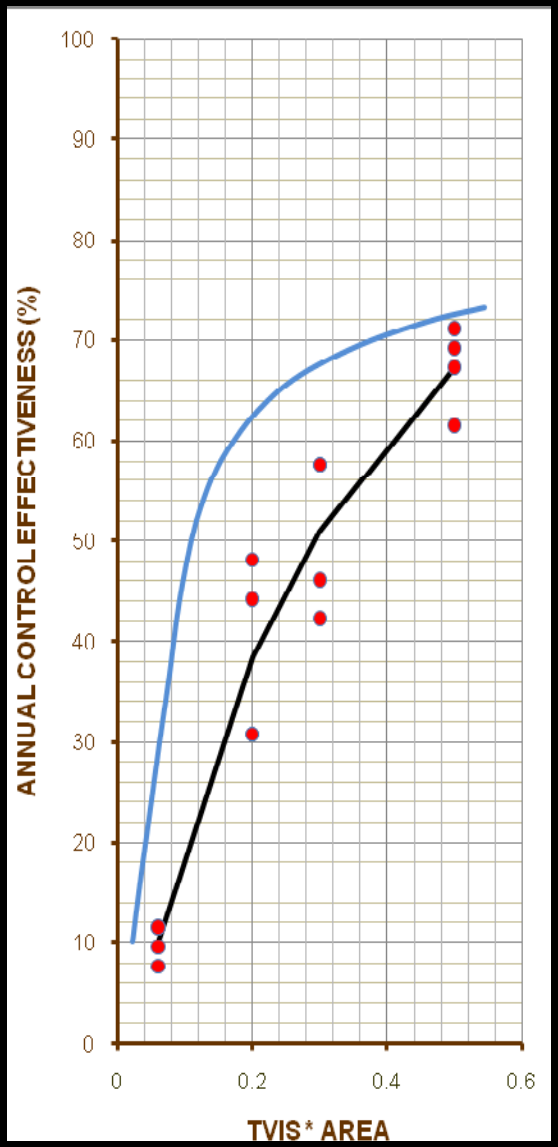
Blinds
Yes
Blind control
Occupant
Lighting system:
On/ Off
Lighting control
Average Occupant

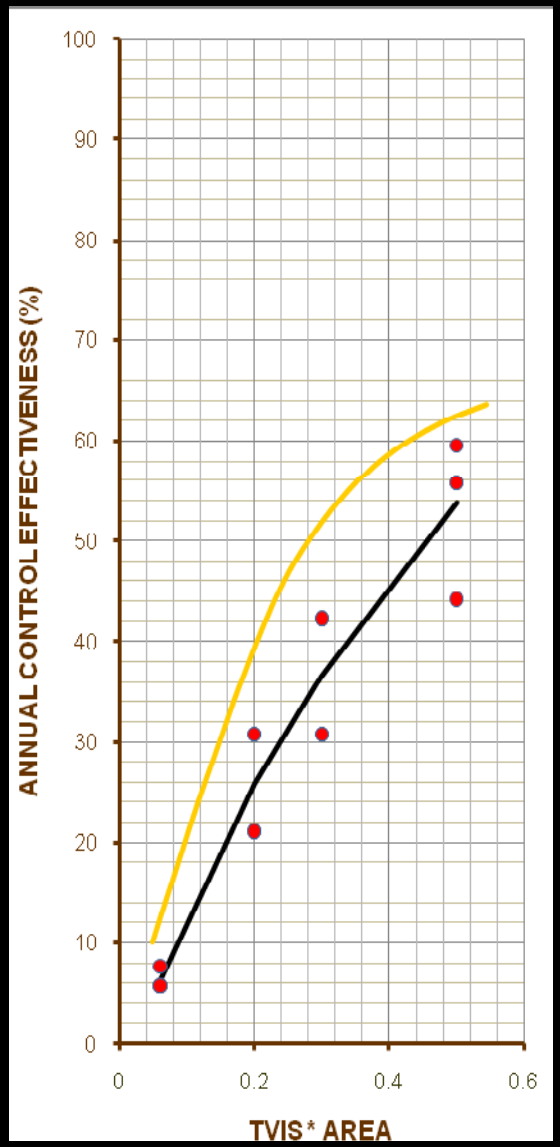


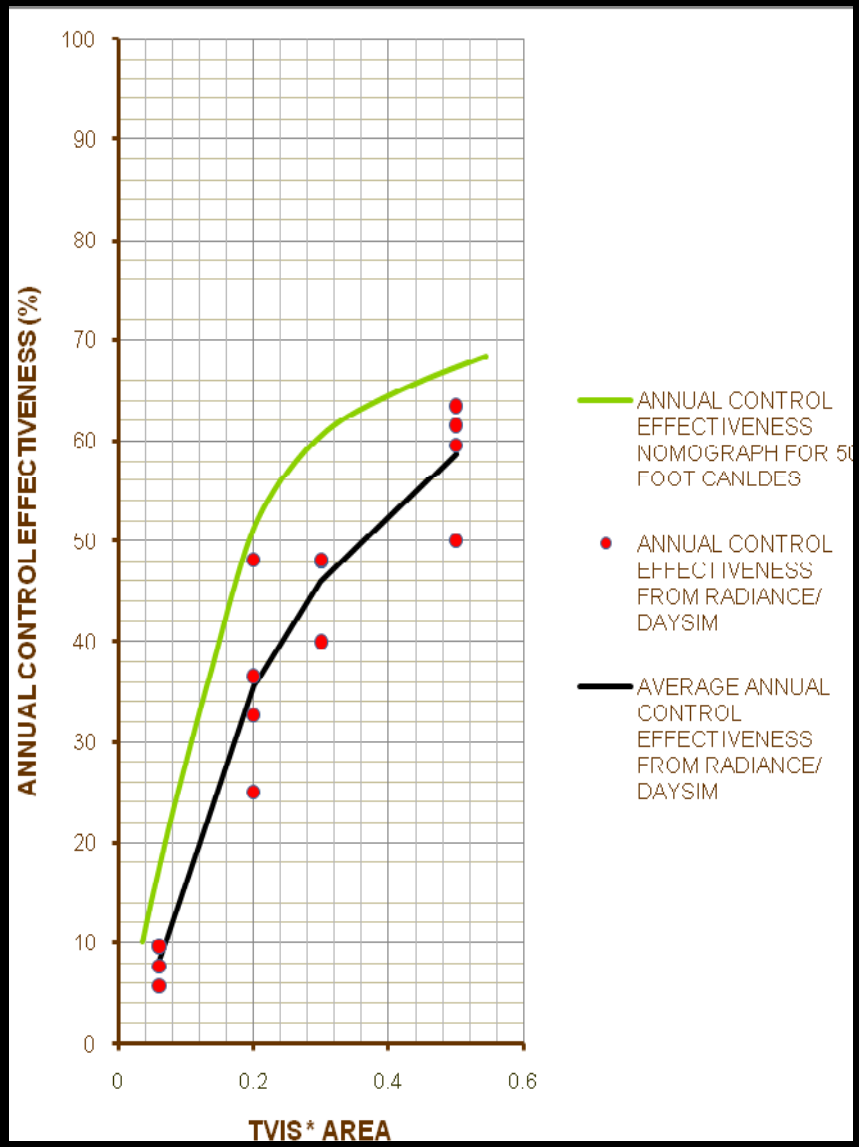
Private office, photo sensor controlled dimming stem

Private office, standard lighting system

ENERGY SAVINGS DUE TO LIGHTING CONTROL SYSTEMS:

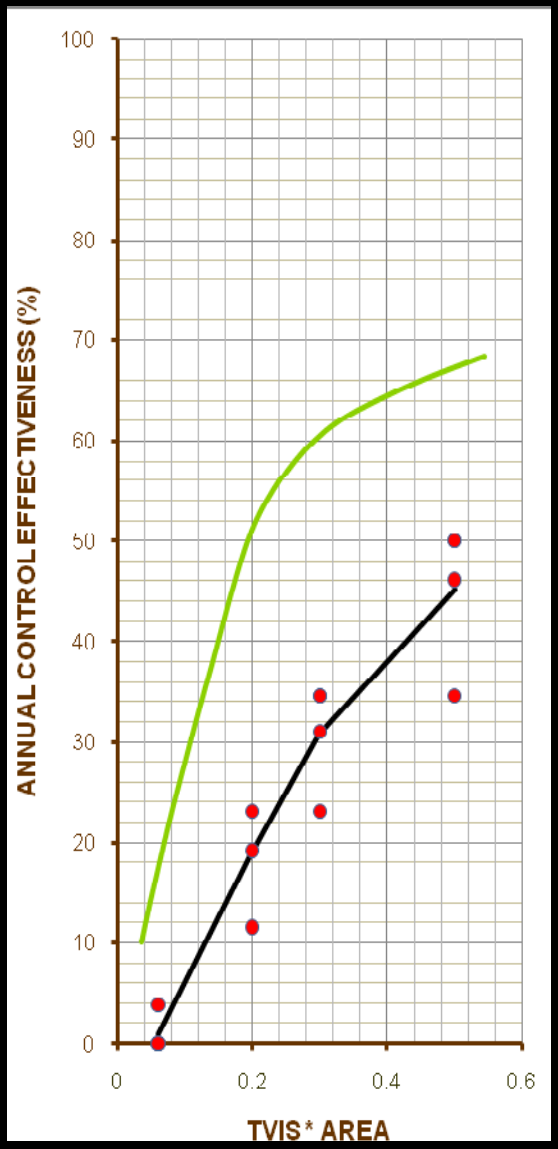






Blinds Yes | **Blind control** Occupant | **Lighting system** Dimming | **Lighting control** Average Occupant

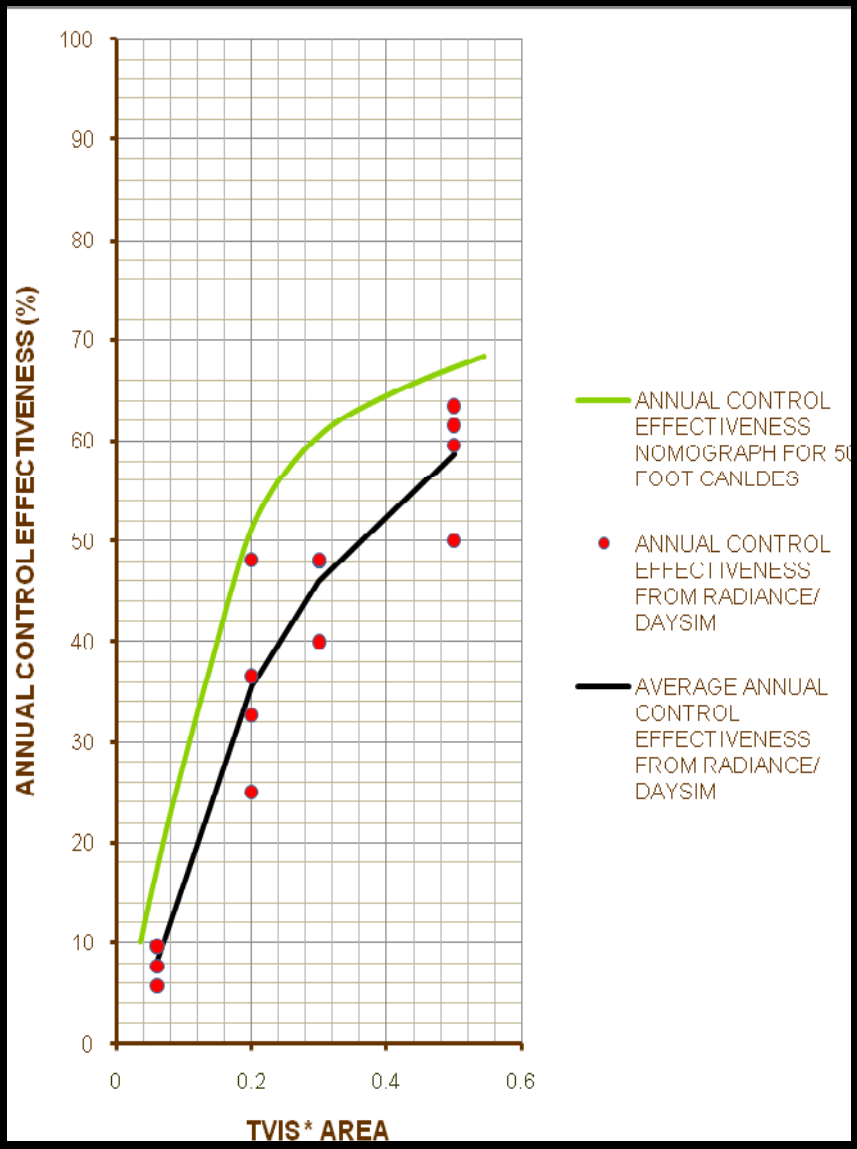
ENERGY SAVINGS DUE TO OCCUPANTS:



Blinds
Yes
Blind control
Occupant
Lighting system:
Dimming
Lighting control
None

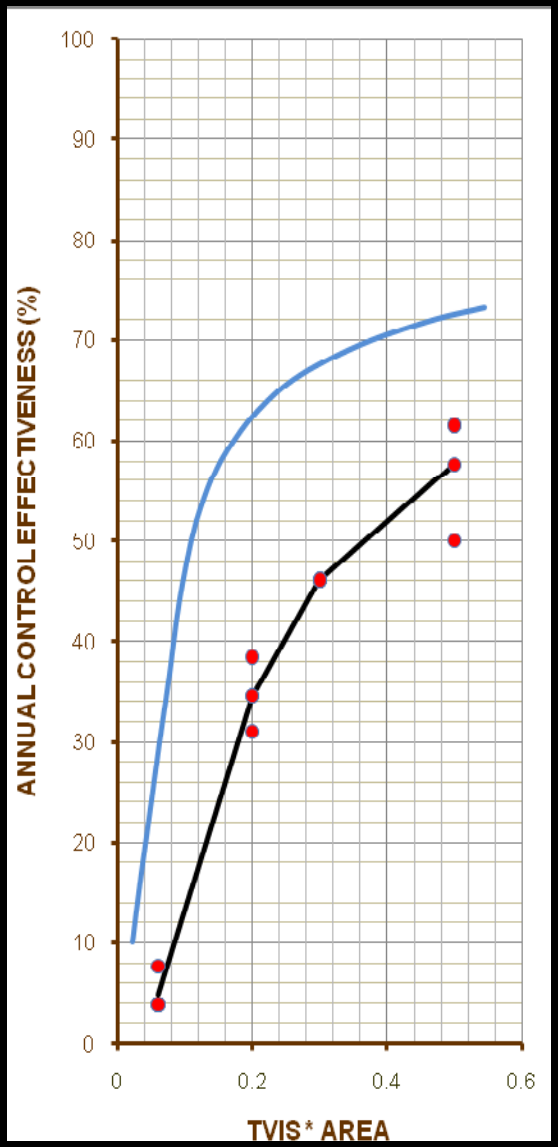
Open plan office, photo sensor controlled dimming system

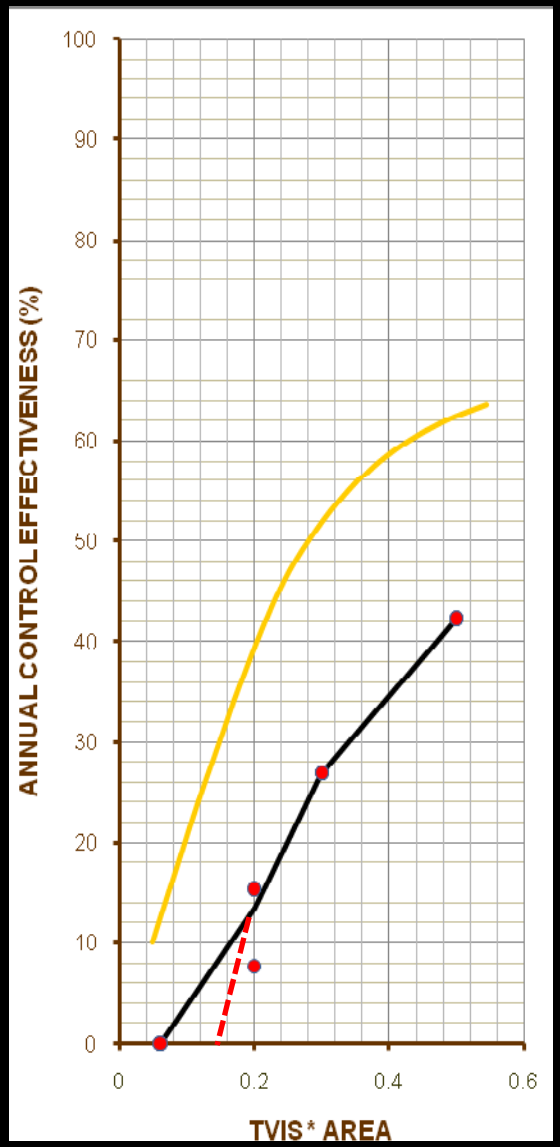
Blinds
Yes
Blind control
Occupant
Lighting system:
Dimming
Lighting control
Average Occupant

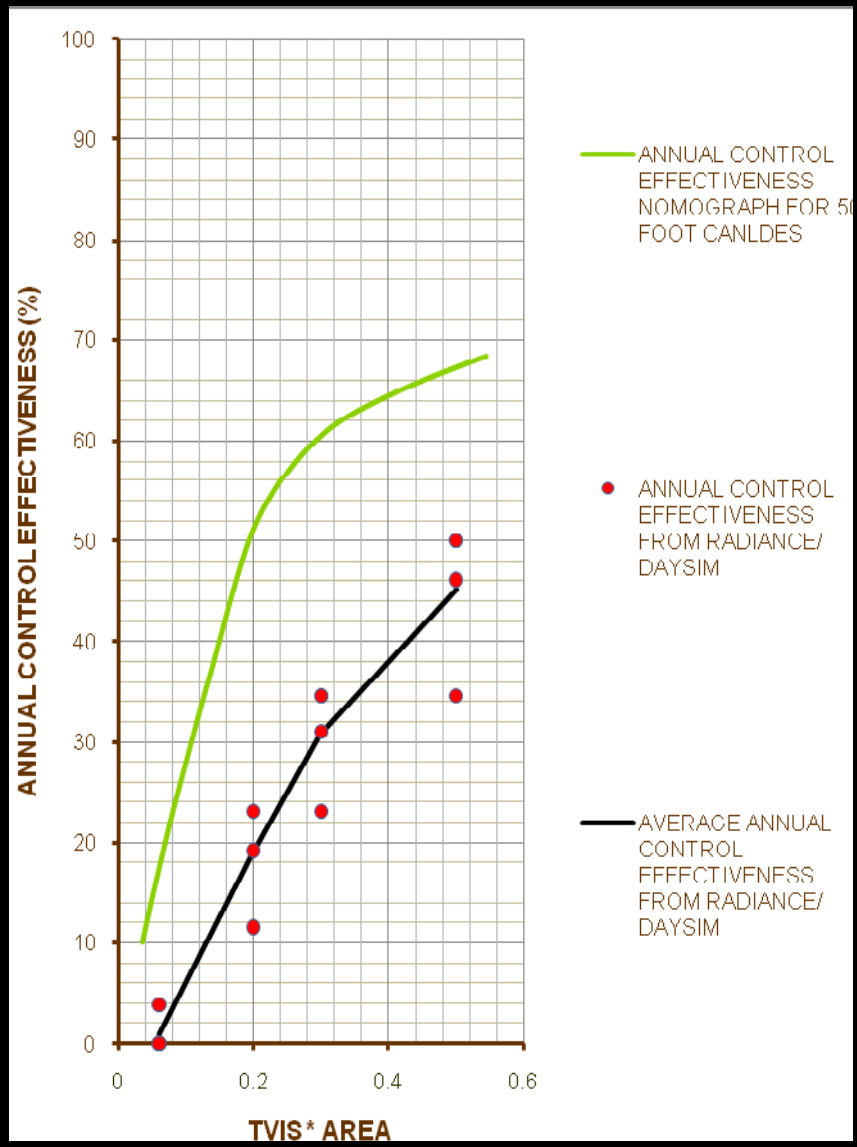


Private office, standard lighting system

ENERGY SAVINGS DUE TO LIGHTING CONTROL SYSTEMS:

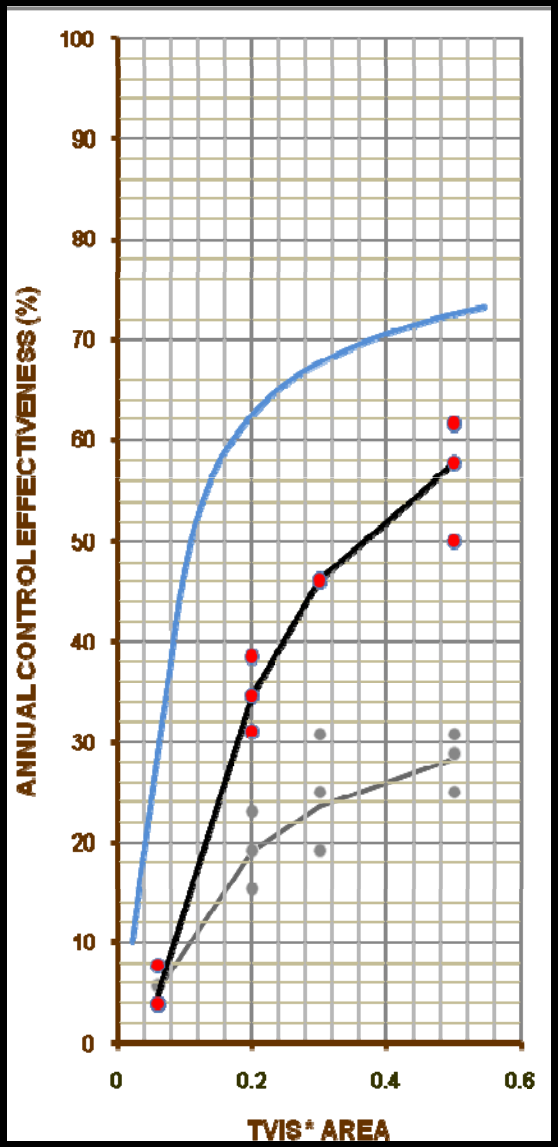


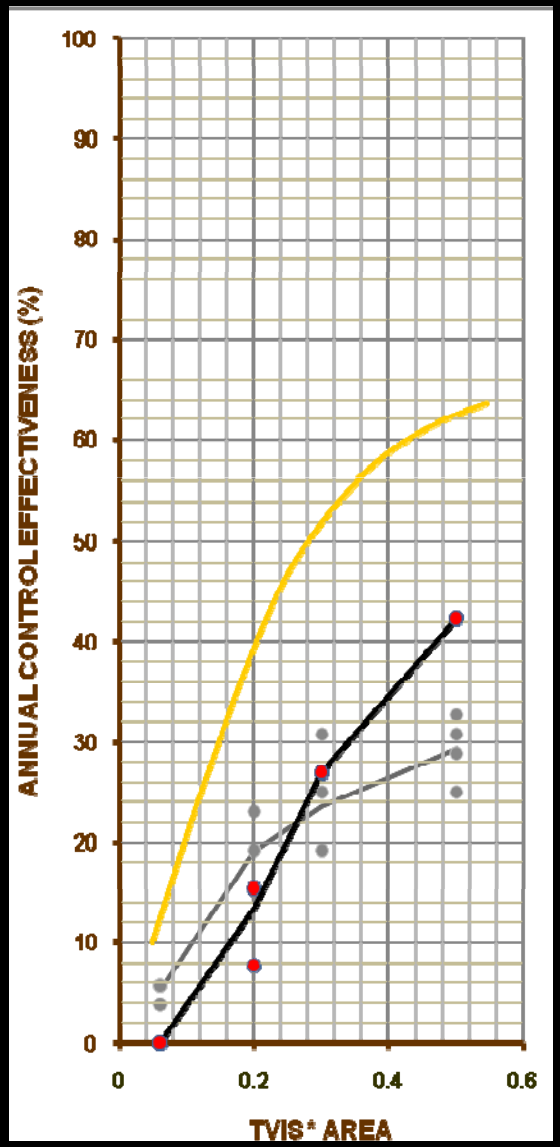


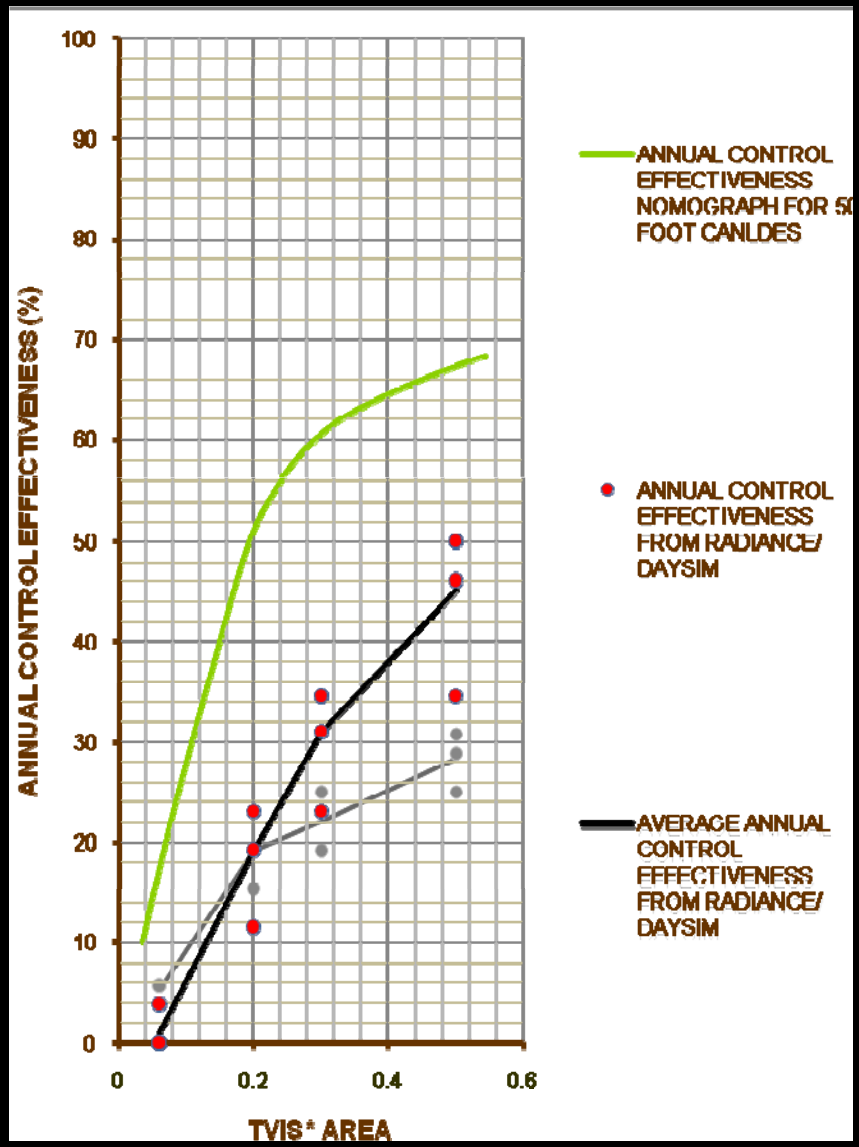


Blinds Yes | **Blind control** Occupant | **Lighting system** Dimming | **Lighting control** None | **Open plan office**

ENERGY SAVINGS DUE TO OCCUPANT BEHAVIOR:



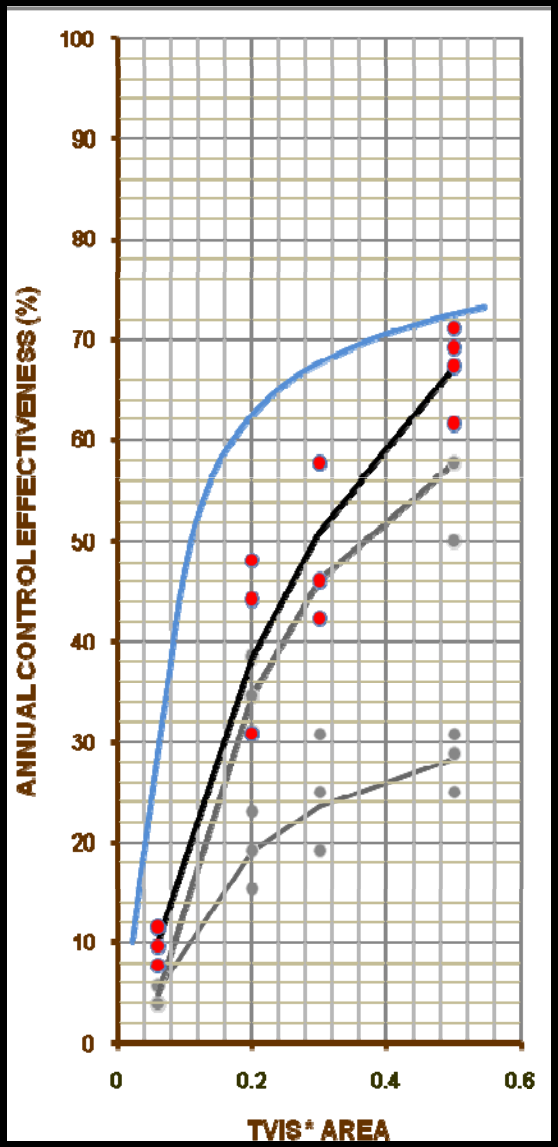


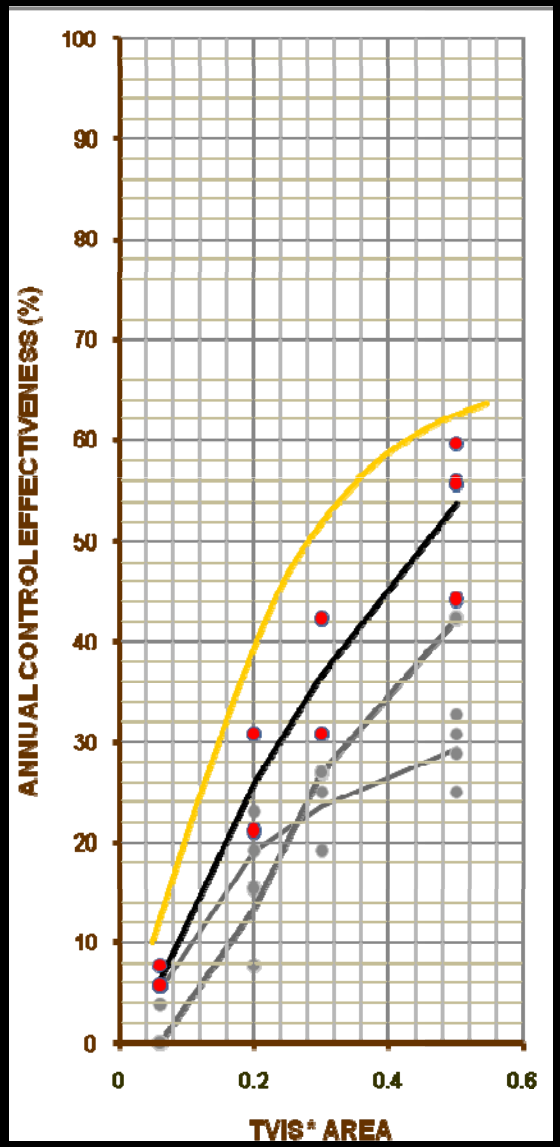


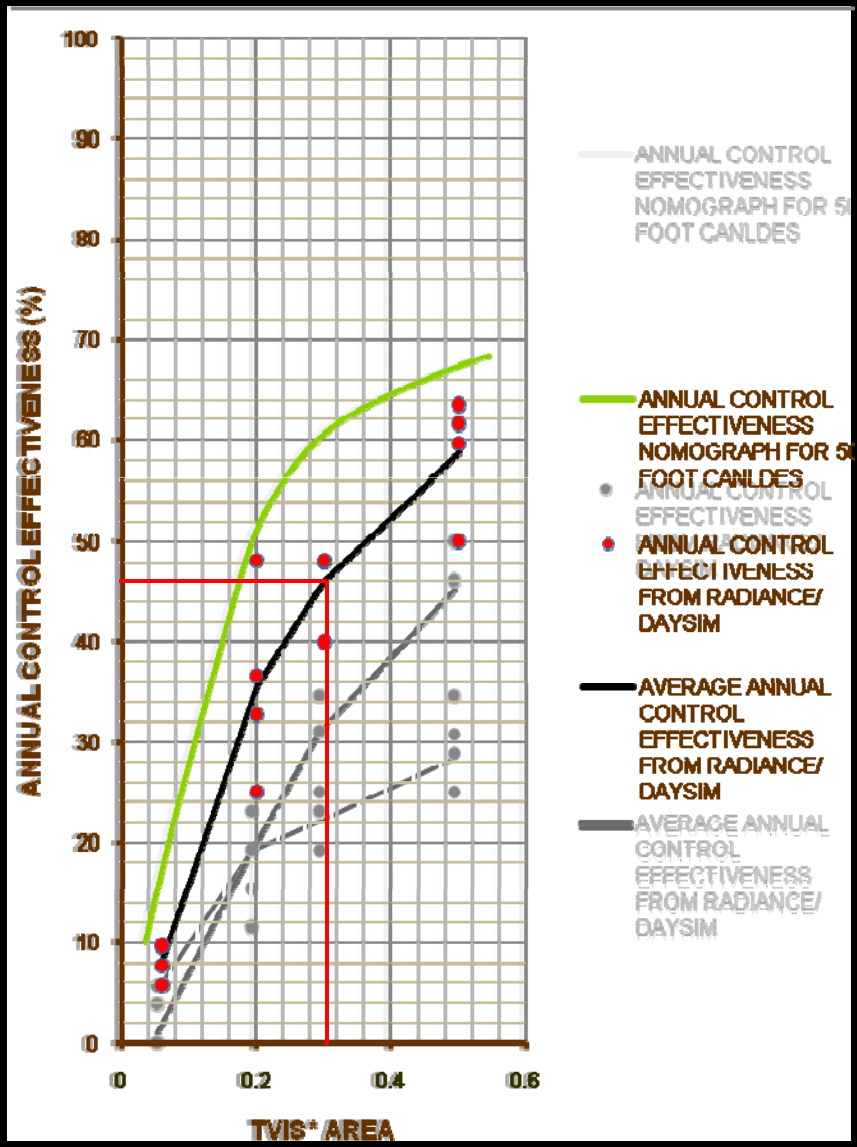
Blinds Yes | **Blind control** Occupant | **Lighting system** Dimming | **Lighting control** None | **Open plan office**

Blinds Yes | **Blind control** Occupant | **Lighting system** On/ Off | **Lighting control** Average Occupant | **Private Office**

ENERGY SAVINGS DUE TO OCCUPANT BEHAVIOR:







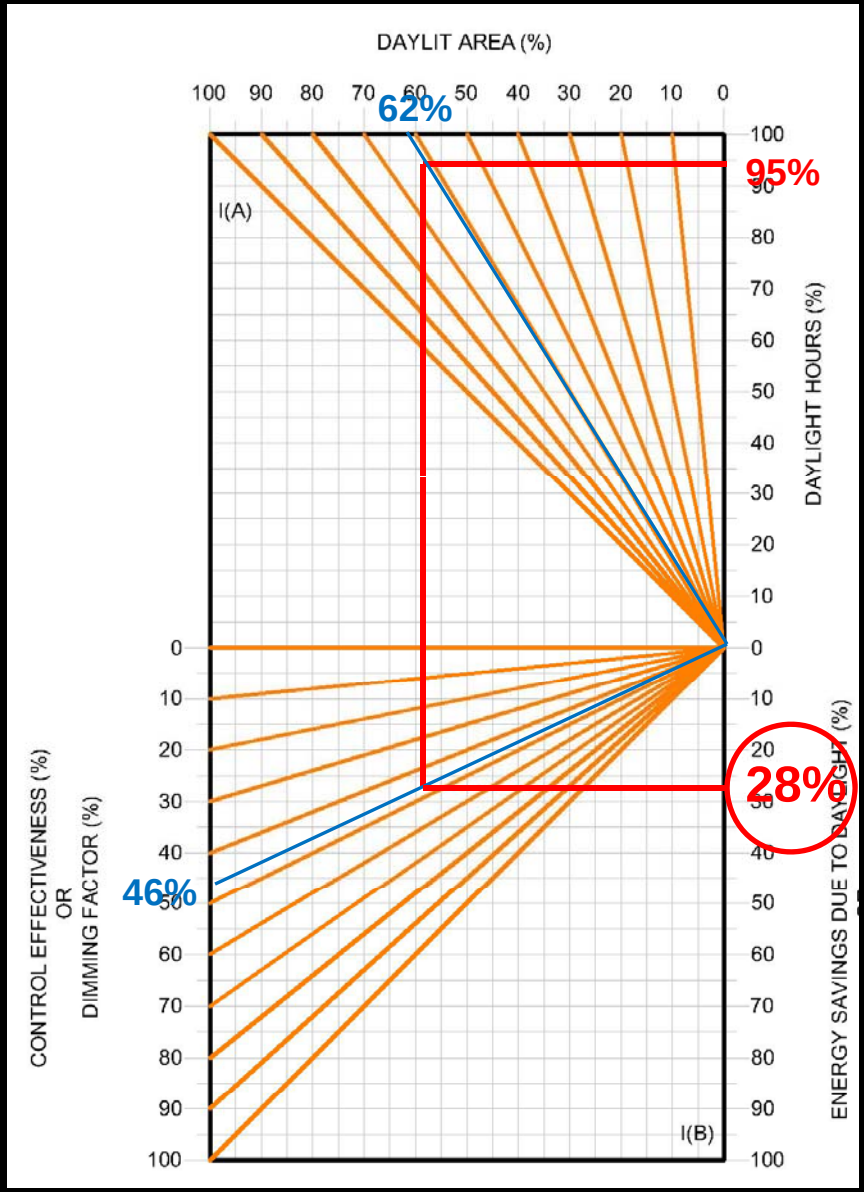
Blinds Yes | **Blind control** Occupant | **Lighting system** Dimming | **Lighting control** Average Occupant | **Private office**

Blinds Yes | **Blind control** Occupant | **Lighting system** Dimming | **Lighting control** None | **Open Plan Office**

Blinds Yes | **Blind control** Occupant | **Lighting system** On/ Off | **Lighting control** Average Occupant | **Private Office**

USING THE NOMOGRAPHS

- Daylight hours: 95%
- Daylit area: 62%
- Threshold Illumination level: 50 foot candles
- TVIS * Area: 0.3
- Annual Control Effectiveness: 46%



THANK YOU

RADIANCE WORKSHOP, October 23 2009

ROHIT MANUDHANE | CHRISTOPH REINHART
Harvard Graduate School of Design