



**Illuminating**  
ENGINEERING SOCIETY



# **IES ROADSHOW 2016 IES District 1, Canada**

**Calgary/Edmonton/Regina  
Bonjour a tous**

**It's Not a Pill, It's Not a Cream,  
It's the Lighting:  
Aging Vision and You**

**Presented by Robert Dupuy, IES, IALD, LC  
Portland, Oregon**

# IES Roadshow 2015-16

---

## Learning Objectives

Participants will be able to:

1. Understand the lighting needs of over 20% of the US/Canada population.
2. Learn about the latest trends in lighting for the older and low vision populations.
3. Understand that aging is a world-wide phenomenon and its impact reaches far beyond senior housing.

This presentation qualifies for:

One (1) IES CEU credit



# An Important Global Trend

---

The world is aging:

2006: 11% of global population aged 60+

2050: 22% of global population aged 60+

More older people than children aged 0-14 for the first time in human history.

285 million people are estimated to be visually impaired worldwide.

About 90% of the world's visually impaired live in low-income settings.

82% of people living with blindness are aged 50 and above.



# UNITED STATES PROJECTIONS

---

- Population aged >65 years
  - from 12.4% in 2000 to 19.6% in 2030
  - 35 million in 2000 → 71 million in 2030
  - roughly 20 percent of the U.S. population
- Population aged >80 years
  - from 9.3 million in 2000 to 19.5 million in 2030



# Why is the World Aging?

---

High fertility after World War II

The result of:

- Reduced death rates at all ages
- Major reductions in the prevalence of infectious and parasitic disease
- Declines in infant and maternal mortality
- Improved nutrition during the 1900s

# Why needs of older people must be understood:

---

Growth of the aging population:

- 23% USA and 25% Canadian population will be 65+ in 2036.

Increase of Visual Impairment with age

- 19% of those 70+ have visual impairment

Visual impairment impacts people of all ages

- 15 million blind/visually impaired people in the US
- Only 1/3 of employment age are in the workforce in both the USA and Canada.

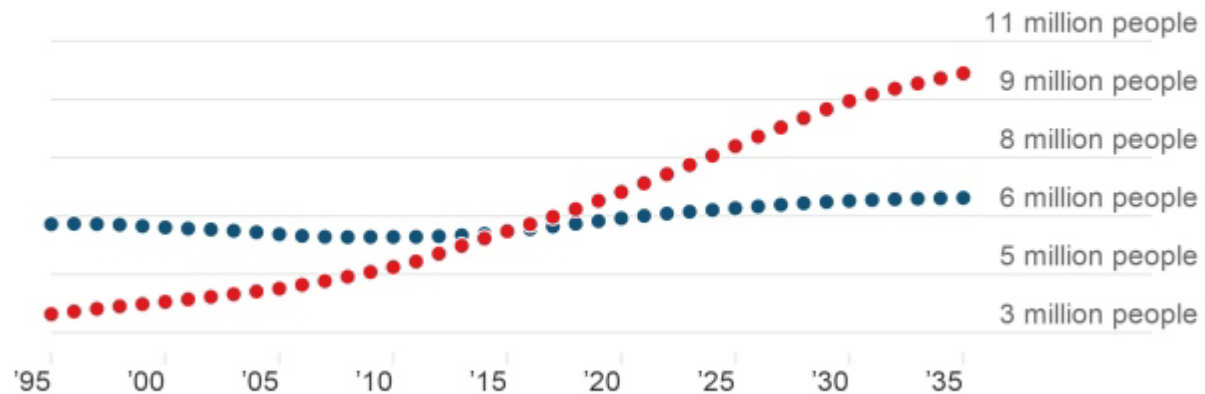
Every year over 50,000 Canadians lose their sight:

- Alberta 52,899
- Saskatchewan 14,256



## Canada now has more seniors than kids under 15

■ Under 15 ■ Over 64



Source: Statistics Canada

Made with Chartbuilder



# Definition of Low Vision

20/70 acuity or worse after  
correction  
(glasses or surgery)



# Overview of Normal Age-Related Changes to Vision

---

Smaller pupil – less responsive

Loss of focusing flexibility

More light scatter within the eye

Slower adaptation to lighting changes

Less sensitive to blue light

Reduce visual acuity

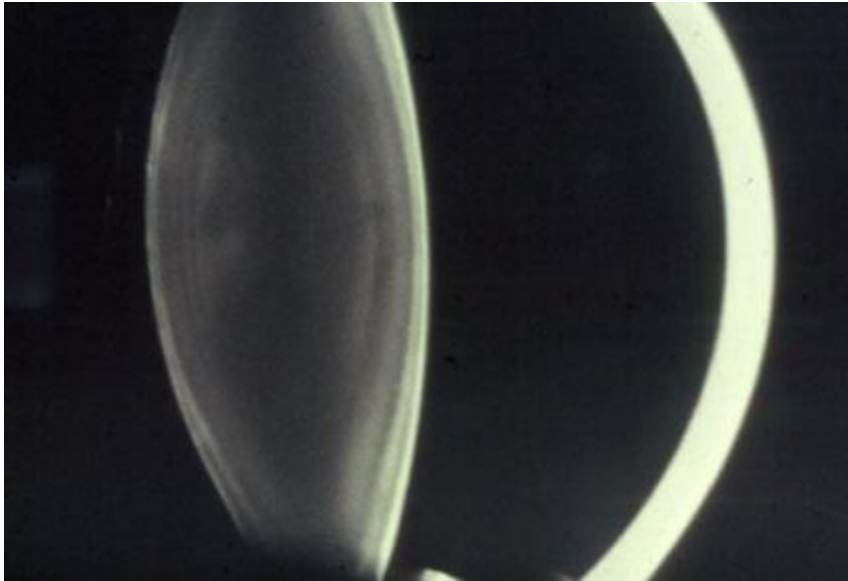
Reduced contrast sensitivity



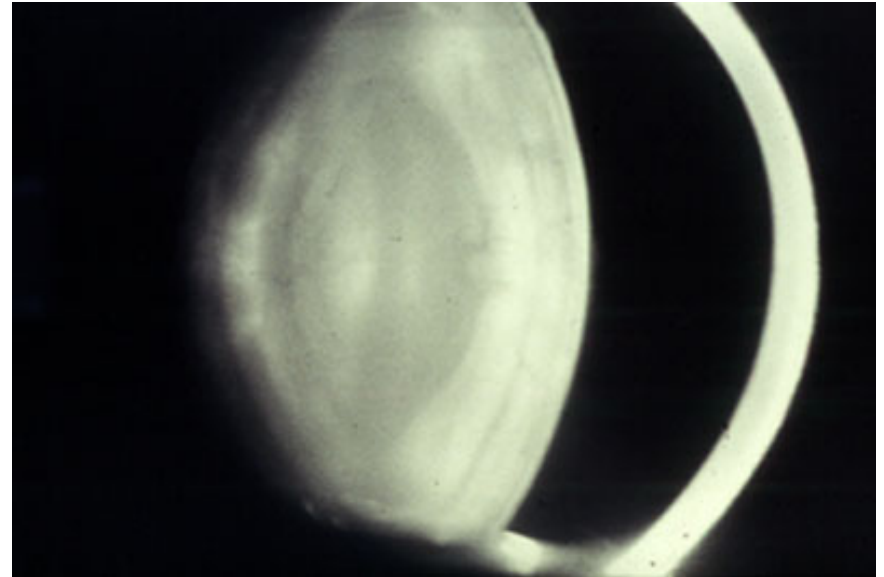
## Changes to the Lens

---

Lens of a 10 year old



Lens of a 65 year old



# Age-Related Eye Diseases Compared to Normal Vision

Courtesy: National Eye Institute, NIH

---



# Age-Related Cataracts

Courtesy: National Eye Institute, NIH

---



Problems

Reduced Contrast

Glare Disability

Haze in the lens

Impacts everyone, sooner or later

Treatment

Surgical removal of lens

# Glaucoma

Courtesy: National Eye Institute, NIH

---



Problems:

Needs strong light

Reduced contrast

Loss of side vision

May lose vision for detail

Treatment:

Medication

Surgery

# Age-Related Macular Degeneration

Courtesy: National Eye Institute, NIH

---



Problems:

Needs good strong light

Seeing faces, reading, details and driving

Affects Central Vision

Generally untreatable

Very common

Severity varies

# Diabetic Retinopathy

Courtesy: National Eye Institute, NIH

---



Problems:

Needs good strong light

Sensitive to Glare

Damage to blood vessels in the retina

45% of diabetics have some stage of retinopathy

Type I & Type II Diabetes

# Implication of Age-Related Vision Loss

---

Falls/Fractures Increase 200%

Limited Mobility in Unfamiliar Areas

Loss of Contrast Sensitivity

- Limits Independence

Reduced Ability to See Fine Detail





# Light for Health—Get Outside!

---



**Vitamin D Synthesis for  
Healthy Bones by light  
on the skin**

**Maintains Circadian  
Rhythm by light through  
the eye**

**Promotes Better Sleep  
Quality**

**Prevents Depression**

**Reduces Agitation**

# Evolutionary Past Compared To Modern Day Light Exposure

---

## Past Times

- Bright, full-spectrum days
- Dark nights

## Modern Times

- Dim, spectrum-restricted days inside buildings
- Lighted nights



# Daylight Exposure Varies Community vs. Care Facilities

---

Minutes of light received daily

Middle-Aged Adults: 58

Assisted Living Residents: 35

Nursing Home Residents: 2



# Interior Lighting: Repeat Nature's Color Rhythm

---



**Cool During the Day**



**Warm at Night**

# Causes of Age-Related Circadian Disruption

---

Changes to the body clock

Neural changes require stronger light input

Less light reaches the retina

Changes to the eye

Less light exposure

Due to decreased mobility

Nursing home placement



# Daylighting

---



More daylight

Large skylights

Larger windows

Need BOTH

skylights and windows

not just windows

# Not all Daylighting is Good!

## Clear Glazing=Glare & Shadows

---



# Not all Daylighting is Good!

## Clear Glazing = Glare & Shadows

---





# Recent Research: Utilizing Bright Light & Melatonin

---

## Study in The Netherlands

### 12 Assisted Care Homes

- 189 Subjects studied over 3.5 years
- Average age 85.5 with Dementia

Riemersmas-van der Lek RT, Swaab DF, Twisk J, Hol EM, Hoogendijk WJG, Van Someren EJW, 2008, *Effect of Bright Light and Melatonin on Cognitive and Noncognitive Function in Elderly Residents of Group Care Facilities*, *Journal of the American Medical Association*, Vol. 299. No.22, pp 2642-2655.



# The Netherlands' Study

---



# Interventions

---

Light: Delivered between 9AM – 6PM (Measured in the direction of gaze)

Active: 1000 lux, 93 footcandles

Color Temperature: 4000K & 5000K

Placebo: 300 lux, 27 footcandles

Melatonin: Taken one hour before bed

Active: 2.5 mg

Placebo: Sugar Pill



# Published Results from the Study in The Netherlands

---

Nightly Restlessness Reduced – 9% per year

Cognitive Impairment Reduced – 5%

Depressive Symptoms Reduced – 19%

Sleep Duration Increased (37 min.) – 8%



---

Older People Need High Levels of Light During the Day

But, darkness when they sleep

Or

Low Levels of Amber Light at Night For Wayfinding\*

\*Some research suggests that the night lighting can be low levels of white

\*In practice red light has been used with success



# Bathroom Lighting at Night

---



Bathrooms need different lighting for Day & Night

Low-light levels at night

Light should be warm in color

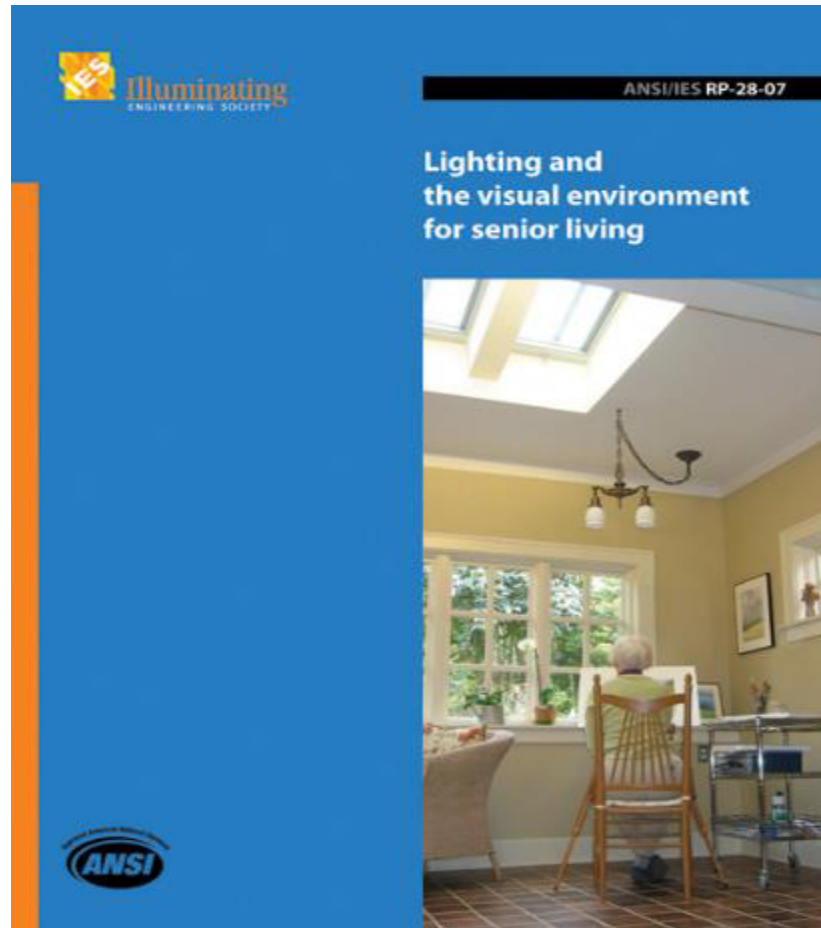
Light the path from bedroom to bathroom

- Amber night lights

# ANSI/IES RP-28-2007

## The Standard

---



# Minimum Light Levels

## ANSI/IES RP-28-07

---

AREA	AMBIENT	TASK
Resident Room	30 FC	75 FC
Dining/Activity	50 FC Day	
Bedrooms	30 FC	75 FC
Hallways (Day)	30 FC	
Hallways (Night)	10 FC Night	





# Key Elements to Improve Lighting to Enhance Vision from ANSI/IES RP-28-07

---

- Provide appropriate light for day & night
- Higher light levels during the day
- Consistent even illumination
- Eliminate glare
- Combine direct/indirect lighting
- Balance brightness of daylight
- Provide gradual changes in light levels
- Provide task lighting for daily living



# Exception to IES Handbook

---

**“Exterior residential lighting criteria discussed here apply to normal-sighted individuals living in single-family homes. Interior residential lighting criteria discussed here apply to those normal-sighted individuals living in single-family detached homes, duplexes, apartments, condominiums or other residential complexes. Individuals with specific vision impairments may require more or less light depending on the visual condition and tasks. These impairments should be identified in programming and require that the lighting be designed accordingly. [4]”**

**Reference [4] is to RP-28-07 listed at the end of the Handbook chapter.**



# Examples of Corridor Lighting

---











# Apartment Lighting

---



# Bathroom Lighting





# New Things To Come

---

Color Tuning

Circadian Rhythm lighting moving into the workplace

Individual controllability of luminaires

Daylight—Is it a right?



# IES Roadshow 2015-2016

---

**Thank you**

**Merci**

**Questions?**

**[www.robertdupuy.net](http://www.robertdupuy.net)**

**[Robert@robertdupuy.net](mailto:Robert@robertdupuy.net)**

