

WELL ACCREDITED PROFESSIONAL WELL AP STUDY CARDS

380+ Questions and Answers
Study Cards!



BEYOND
SMART CITIES

LEARN.BEYONDSMARTCITIES.IN

**New and Existing Buildings -
What % of total floor area is
occupied by the building owner**



© Beyond Smart Cities Private Limited

90%



© Beyond Smart Cities Private Limited

**Core & Shell - what % of area
is controlled by building
owner?**



© Beyond Smart Cities Private Limited

**25% , but 100% is included in scope
for design**



© Beyond Smart Cities Private Limited

Current pilots include which 4
space types?



© Beyond Smart Cities Private Limited

Multifamily residential
education facilities
retail
restaurant commercial kitchens



© Beyond Smart Cities Private Limited

What are future pilot space
types?



© Beyond Smart Cities Private Limited

Communities, exercise facilities,
public assembly, healthcare



© Beyond Smart Cities Private Limited

How many total features are there?



© Beyond Smart Cities Private Limited

102



© Beyond Smart Cities Private Limited

Which 5 stakeholders must attend the Stakeholder Charrette?



© Beyond Smart Cities Private Limited

owner, architects, engineers, and facilities management



© Beyond Smart Cities Private Limited

In the Stakeholder Charette
which 3 tasks must be
completed?



© Beyond Smart Cities Private Limited

1. Perform a values assessment
2. discuss needs of occupants,
focusing on wellness
3. set future meetings to engage
contractors etc.
4. prepare written doc detailing
building's health mission



© Beyond Smart Cities Private Limited

Once construction is complete
what must the stakeholder
charette do?



© Beyond Smart Cities Private Limited

1. tour the building as a group
2. discuss how operations will
adhere to the WELL standard



© Beyond Smart Cities Private Limited

How much time do standard
and pilot projects have to
complete document submission
from date of registration?



© Beyond Smart Cities Private Limited

standard projects 5 years; pilot 3
years



© Beyond Smart Cities Private Limited

what 3 types of documents are
submitted?



© Beyond Smart Cities Private Limited

annotated documents;
letters of assurance;
general documents



© Beyond Smart Cities Private Limited

What do Annotated documents include?



© Beyond Smart Cities Private Limited

existing documents marked up to
provide additional info -
design drawings,
operations schedules
policy documents



© Beyond Smart Cities Private Limited

What do General Documents include?



© Beyond Smart Cities Private Limited

provide details on overall project -
floor plans,
lighting,
mechanical drawings



© Beyond Smart Cities Private Limited

**How long does the WELL
Assessor have to review 1st
round docs?**



© Beyond Smart Cities Private Limited

20-25 business days



© Beyond Smart Cities Private Limited

**After the Performance Verification
is complete, how long does the
Assessor have to file the report
and score card?**



© Beyond Smart Cities Private Limited

40-45 days



© Beyond Smart Cities Private Limited

How many deaths are caused
by air pollution annually?



© Beyond Smart Cities Private Limited

50,000 in US
7 million worldwide (1 in 8)



© Beyond Smart Cities Private Limited

How much air do we breathe
per day?



© Beyond Smart Cities Private Limited

15,000 liters



© Beyond Smart Cities Private Limited

What are the 6 major air pollutants?



© Beyond Smart Cities Private Limited

- Carbon Monoxide (CO)
- Lead (Pb)
- Nitrogen dioxide
- Ozone
- Particulates (PM10 and PM 2.5)
- Sulfur Dioxide



© Beyond Smart Cities Private Limited

How many Air features are there and how many preconditions/optimizations?



© Beyond Smart Cities Private Limited

29 features
12 Preconditions
17 optimizations



© Beyond Smart Cities Private Limited

Air Quality, part I, VOCs:
what are the levels for
Formaldehyde and total VOCs?



© Beyond Smart Cities Private Limited

Formaldehyde is 27 ppb
VOCs less than 500 ug/m³



© Beyond Smart Cities Private Limited

part 2, particulates and
inorganics:
what are the 4 types?



© Beyond Smart Cities Private Limited

1. Carbon monoxide
2. Fine Particles (PM 2.5)
3. Coarse Particles (PM 10)
4. Ozone



© Beyond Smart Cities Private Limited

Where is it measured and
what's the threshold?



© Beyond Smart Cities Private Limited

4 pCi/L at lowest occupied level of
building



© Beyond Smart Cities Private Limited

Smoking Ban:
How much does smoking
shorten life expectancy?



© Beyond Smart Cities Private Limited

10 years



© Beyond Smart Cities Private Limited

Smoking Ban:
how many ingredients are in a
cigarette and how many are
toxic?



© Beyond Smart Cities Private Limited

**600 ingredients burn to form 7,000
compounds of which 69 are known
carcinogens**



© Beyond Smart Cities Private Limited

**How large is the area in which
smoking is banned?**



© Beyond Smart Cities Private Limited

**and signage about smoking
hazards along all walkways beyond
25ft with signs every 100'**



© Beyond Smart Cities Private Limited

Ventilation effectiveness –
which regulation sets
standards for adequate
ventilation?



© Beyond Smart Cities Private Limited

ASHRAE 62.1.2013



© Beyond Smart Cities Private Limited

Ventilation effectiveness – part
I – design
Projects demonstrate that
ambient air quality within 1 mi
is compliant with what?



© Beyond Smart Cities Private Limited

EPA's NAAQs for 95% of all hours in
previous year



© Beyond Smart Cities Private Limited

Ventilation effectiveness - part 2 - (DCV) Demand Controlled Ventilation

A DCV system is used to keep
CO2 levels below ____ppm, when
the space is ____ or larger and
occupancy is more than ____
people per _____ SF



© Beyond Smart Cities Private Limited

CO2 = 800 ppm
space = 500 SF or larger
occupancy = 25 people per 1,000 SF



© Beyond Smart Cities Private Limited

Ventilation effectiveness - part 3 System Balancing

When does HVAC system get
tested and balanced and what
is the documentation required?



© Beyond Smart Cities Private Limited

Systems get balanced after
completion and before occupancy;
doc is an annotated CX Report



© Beyond Smart Cities Private Limited

Need to meet one of which 3 requirements?



© Beyond Smart Cities Private Limited

- 100% of CARB or SCAQMD Rule 1113
- 90% by volume of CDPH
- ASTM standards



© Beyond Smart Cities Private Limited

What's ASTM



© Beyond Smart Cities Private Limited

American Society of Testing & Materials, 12,000 standards



© Beyond Smart Cities Private Limited

VOC Reduction - part 2
Adhesives and Sealants:
need to meet one of which 3
requirements?



© Beyond Smart Cities Private Limited

1. 100% SCAQMD Rule IIII3
2. 90% by volume of CDPH
3. ASTM standards



© Beyond Smart Cities Private Limited

VOC Reduction - part 3&4 -
flooring and insulation:
both must meet what
standard?



© Beyond Smart Cities Private Limited

- I. 100% by volume of CDPH



© Beyond Smart Cities Private Limited

VOC Reduction - part 5 -
Furniture
must meet what standard?



© Beyond Smart Cities Private Limited

95% by cost ANSI/BIFMA e3-2011



© Beyond Smart Cities Private Limited

Air Filtration, Part I - Filter
Accommodation
What two things must
recirculated air systems be
able to accommodate?



© Beyond Smart Cities Private Limited

1. rack space and fan capacity for
future carbon filters
2. additional filters



© Beyond Smart Cities Private Limited

**Air Filtration, Part 2 – Particle
Filtration:
What size MERV filter is used
for outdoor air?**



© Beyond Smart Cities Private Limited

MERV 13 or higher



© Beyond Smart Cities Private Limited

**Ambient outdoor PM10 and PM
2.5 levels measured _____
distance from building are
measured below WELL
standards for _____how long**



© Beyond Smart Cities Private Limited

**1 mile
95% of all hours throughout
demonstration**



© Beyond Smart Cities Private Limited

How often do projects need to provide IWBI with air filtration maintenance records?



© Beyond Smart Cities Private Limited

annually



© Beyond Smart Cities Private Limited

Microbe and Mold Control:

1. What devices are used, where?
2. What should be inspected and how often?



© Beyond Smart Cities Private Limited

1. UVGI - ultraviolet germicidal irradiation;
2. on cooling coils and drain pans;
3. ceilings, walls and floors for discoloration, visible mold, water damage, pooling - quarterly



© Beyond Smart Cities Private Limited

Construction Pollution, Part 1?



© Beyond Smart Cities Private Limited

Duct Protection – they are sealed during construction and vacuumed out prior to installing grills



© Beyond Smart Cities Private Limited

Construction Pollution, Part 2 – Filter Replacement When are they replaced?



© Beyond Smart Cities Private Limited

If used during construction, all filters replaced Prior to occupancy



© Beyond Smart Cities Private Limited

What 3 techniques are used to
reduce/contain/remove dust
during construction?



© Beyond Smart Cities Private Limited

1. seal doors and windows with temporary barriers
2. walk-off mats
3. tools have dust guards/collectors



© Beyond Smart Cities Private Limited

Healthy Entrance - Part I walk
off mats: Size?



© Beyond Smart Cities Private Limited

width of entrance and 10ft long



© Beyond Smart Cities Private Limited

**Cleaning Protocol (for air
quality):**
**Part I Cleaning Plan - Which 4
elements must be in the plan?**



© Beyond Smart Cities Private Limited

1. list of high-touch and low-touch surfaces
2. a schedule
3. cleaning protocol (covers evaluation, product selection, disinfection, entryway maint., and waste stream) and dated logs
4. List of approved product seals



© Beyond Smart Cities Private Limited

**How many features in water?
Preconditions?**



© Beyond Smart Cities Private Limited

**8 water features, 5 preconditions
(30-34)**



© Beyond Smart Cities Private Limited

What % of water is the human
body



© Beyond Smart Cities Private Limited

more than 2/3



© Beyond Smart Cities Private Limited

How much water should women
and men drink?



© Beyond Smart Cities Private Limited

W - 2.7 L
Men - 3.7 L



© Beyond Smart Cities Private Limited

**How many deaths annually
attributed to unsafe water?**



© Beyond Smart Cities Private Limited

2 million



© Beyond Smart Cities Private Limited

**Fundamental Water Quality -
What are the two major
indicators for the presence of
other contaminants?**



© Beyond Smart Cities Private Limited

Turbidity and total Coliforms



© Beyond Smart Cities Private Limited

What are the limits for
Turbidity and Microorganisms?



© Beyond Smart Cities Private Limited

ArMeNiAn Cole
Arsenic
Mercury
Nickel
Antimony
Copper
Lead



© Beyond Smart Cities Private Limited

Which filtration is used for
dissolved metals?
When are they replaced?



© Beyond Smart Cities Private Limited

PCBs
Benzene
Styrene
Vinyl Chloride
Ethylbenzene
Toluene
Xylenes
TCE



© Beyond Smart Cities Private Limited

Organic Pollutants - what 3 main adverse health effects?



© Beyond Smart Cities Private Limited

1. cancer
2. immune deficiencies
3. nervous system damage



© Beyond Smart Cities Private Limited

Ag contaminants: what % of surface streams and groundwater contaminated in the '90s



© Beyond Smart Cities Private Limited

all streams in ag/urban/mixed use areas; 30-60% of groundwater



© Beyond Smart Cities Private Limited

Ag contaminants -
water must meet limits for what
4 chemicals and which
fertilizer?



© Beyond Smart Cities Private Limited

1. Atrazine (pesticide - endocrine disruptor/cardiovascular)
2. Simazine
3. Glyphosate (kidney and reproductive problems)
4. 2,4-D
5. Nitrates less than 10 mg/L



© Beyond Smart Cities Private Limited

Public Water Additives:
what are the limits for two
disinfectants?



© Beyond Smart Cities Private Limited

1. chlorine 0.6 mg/l and
2. chloramine 4 mg/L



© Beyond Smart Cities Private Limited

Public Water Additives:
what are the limits for two
disinfectant byproducts
(cancer & kidney damage)



© Beyond Smart Cities Private Limited

1. trihalomethanes (THM) 0.08 mg/L and
2. halocetic acids (HAAs) 0.06 mg/L



© Beyond Smart Cities Private Limited

Public Water Additives:
what are the limits for flouride?



© Beyond Smart Cities Private Limited

less than 4.0 mg/L



© Beyond Smart Cities Private Limited

Periodic Drinking Water
Quality Testing (optimization)
how often is testing done and
reports submitted?



© Beyond Smart Cities Private Limited

tested quarterly
reports submitted annually, kept for
3 years



© Beyond Smart Cities Private Limited

What is the BMI of an
overweight person -
what % of US population
% of world population



© Beyond Smart Cities Private Limited

25-29.9
69% US
39% world



© Beyond Smart Cities Private Limited

BMI of an Obese person
what % of US population
% of world population



© Beyond Smart Cities Private Limited

over 30
35% US
13% world



© Beyond Smart Cities Private Limited

How much \$\$ is spent annually
marketing junk food to children
and teens?



© Beyond Smart Cities Private Limited

\$1.6 billion



© Beyond Smart Cities Private Limited

How many deaths worldwide
from insufficient veggie and
fruit intake?



© Beyond Smart Cities Private Limited

2.7 million
one of the top 10 health risks



© Beyond Smart Cities Private Limited

What's an SSB? what are 6
health risks?



© Beyond Smart Cities Private Limited

Sugar-sweetened beverage
diabetes
metabolic syndrome
obesity
hypertension
depression



© Beyond Smart Cities Private Limited

How many features in
Nourishment?



© Beyond Smart Cities Private Limited

15 features
#38-45 are Preconditions (8)
#46-52 are optimizations (7)



© Beyond Smart Cities Private Limited

Veggies and fruit
At least ____% of available
food options are fruits and
____vegetables



© Beyond Smart Cities Private Limited

50% fruits and non-fried
vegetables



© Beyond Smart Cities Private Limited

Dietary guidelines - how many servings of fruits and veggies?



© Beyond Smart Cities Private Limited

4 fruits, 5 veggie servings per day



© Beyond Smart Cities Private Limited

Processed foods - high in
sugars/calories/fats:
No beverage with more than
_____g of sugar per container
is sold



© Beyond Smart Cities Private Limited

30g



© Beyond Smart Cities Private Limited

At least 50% of beverages
have less than _____g of sugar
per 8oz



© Beyond Smart Cities Private Limited

15 g



© Beyond Smart Cities Private Limited

How many teaspoons of sugar
are recommended per day?
What's the average
consumed?



© Beyond Smart Cities Private Limited

6-9 tsp
22+ tsp



© Beyond Smart Cities Private Limited

Food Allergies
How many people have
celiacs?



© Beyond Smart Cities Private Limited

3 million



© Beyond Smart Cities Private Limited

Food Allergies
What % of adults and children
have allergies?



© Beyond Smart Cities Private Limited

4% adults
8% children



© Beyond Smart Cities Private Limited

What are the 9 common food allergens?



© Beyond Smart Cities Private Limited

1. peanuts
2. tree nuts
3. fish
4. shellfish
5. milk/dairy
6. soy
7. egg
8. wheat
9. gluten



© Beyond Smart Cities Private Limited

Hand Washing
Foodborne illness causes how
many annual deaths and
illnesses in US?



© Beyond Smart Cities Private Limited

48 million illnesses
128,000 hospitalizations
3,000 deaths



© Beyond Smart Cities Private Limited

**Hand washing
Sink dimensions?**



© Beyond Smart Cities Private Limited

**basin 9" in width and length
water column 10" long**



© Beyond Smart Cities Private Limited

**What is the BMI of an
overweight person -
what % of US population
% of world population**



© Beyond Smart Cities Private Limited

**25-29.9
69% US
39% world**



© Beyond Smart Cities Private Limited

BMI of an Obese person
what % of US population
% of world population



© Beyond Smart Cities Private Limited

over 30
35% US
13% world



© Beyond Smart Cities Private Limited

How much \$\$ is spent annually
marketing junk food to children
and teens?



© Beyond Smart Cities Private Limited

\$1.6 billion



© Beyond Smart Cities Private Limited

How many deaths worldwide
from insufficient veggie and
fruit intake?



© Beyond Smart Cities Private Limited

2.7 million
one of the top 10 health risks



© Beyond Smart Cities Private Limited

What's an SSB? what are 6
health risks?



© Beyond Smart Cities Private Limited

Sugar-sweetened beverage
diabetes
metabolic syndrome
obesity
hypertension
depression



© Beyond Smart Cities Private Limited

How many features in
Nourishment?



© Beyond Smart Cities Private Limited

15 features
#38-45 are Preconditions (8)
#46-52 are optimizations (7)



© Beyond Smart Cities Private Limited

Veggies and fruit
At least ____% of available
food options are fruits and
____vegetables



© Beyond Smart Cities Private Limited

50% fruits and non-fried
vegetables



© Beyond Smart Cities Private Limited

Dietary guidelines - how many servings of fruits and veggies?



© Beyond Smart Cities Private Limited

4 fruits, 5 veggie servings per day



© Beyond Smart Cities Private Limited

Processed foods - high in
sugars/calories/fats:
No beverage with more than
_____g of sugar per container
is sold



© Beyond Smart Cities Private Limited

30g



© Beyond Smart Cities Private Limited

at least 50% of beverages
have less than _____g of sugar
per 8oz



© Beyond Smart Cities Private Limited

15 g



© Beyond Smart Cities Private Limited

How many teaspoons of sugar
are recommended per day?
What's the average
consumed?



© Beyond Smart Cities Private Limited

6-9 tsp
22+ tsp



© Beyond Smart Cities Private Limited

Food Allergies
How many people have
celiacs?



© Beyond Smart Cities Private Limited

3 million



© Beyond Smart Cities Private Limited

Food Allergies
What % of adults and children
have allergies?



© Beyond Smart Cities Private Limited

4% adults
8% children



© Beyond Smart Cities Private Limited

What are the 9 common food allergens?



© Beyond Smart Cities Private Limited

1. peanuts
2. tree nuts
3. fish
4. shellfish
5. milk/dairy
6. soy
7. egg
8. wheat
9. gluten



© Beyond Smart Cities Private Limited

Hand Washing
Foodborne illness causes how many annual deaths and illnesses in US?



© Beyond Smart Cities Private Limited

48 million illnesses
128,000 hospitalizations
3,000 deaths



© Beyond Smart Cities Private Limited

Hand washing
Sink dimensions?



© Beyond Smart Cities Private Limited

basin 9" in width and length
water column 10" long



© Beyond Smart Cities Private Limited

How many adults have chronic
sleep disorders?



© Beyond Smart Cities Private Limited

50-70 million



© Beyond Smart Cities Private Limited

what 6 health risks are sleep deprivation linked to?



© Beyond Smart Cities Private Limited

diabetes
obesity
depression
heart attack
hypertension
stroke



© Beyond Smart Cities Private Limited

Rods facilitate what type of vision?



© Beyond Smart Cities Private Limited

peripheral and dim lighting



© Beyond Smart Cities Private Limited

Cones facilitate what type of vision?



© Beyond Smart Cities Private Limited

daytime and color



© Beyond Smart Cities Private Limited

What are ipRGCs and what type of vision?



© Beyond Smart Cities Private Limited

Intrinsically Photosensitive Retinal Ganglion Cells
sluggish, non-image forming, see light over long-term, used in circadian system



© Beyond Smart Cities Private Limited

What is our internal clock
called that synchronizes
physiology over 24-hr cycle?



© Beyond Smart Cities Private Limited

circadian rhythm



© Beyond Smart Cities Private Limited

What are external cues called,
including light, that align
physiology to solar day?



© Beyond Smart Cities Private Limited

Zeitgebers - keeps body clock
synchronized - circadian photo
entrainment



© Beyond Smart Cities Private Limited

Light exposure in the late
night/early morning (4-6am)
leads to _____.



© Beyond Smart Cities Private Limited

phase advance - shifting our
rhythms forward



© Beyond Smart Cities Private Limited

Light exposure in the late
afternoon/early night (4-
6pm) shifts our rhythms
_____.



© Beyond Smart Cities Private Limited

backward - phase delay



© Beyond Smart Cities Private Limited

How many features in Light,
and what's the last
precondition?



© Beyond Smart Cities Private Limited

11 features in Light, 53-63
4 preconditions 53-56



© Beyond Smart Cities Private Limited

What are the last precondition
feature #s for the first 4
concepts?



© Beyond Smart Cities Private Limited

12 for air, 34 for water, 45 for
nutrition, 56 for light



© Beyond Smart Cities Private Limited

Visual Lighting Design
Ambient light levels of _____
lux is sufficient - but the
requirement is at least _____ lux
measured _____ above floor.



© Beyond Smart Cities Private Limited

300 lux
215 lux 30" above floor



© Beyond Smart Cities Private Limited

If light is below 300 lux, then
task lights providing _____ to
_____ lux need to be provided at
work stations



© Beyond Smart Cities Private Limited

300-500 lux



© Beyond Smart Cities Private Limited

Ambient light system needs to be zoned in independently controlled banks no larger than _____ Sf or _____% of open floor area



© Beyond Smart Cities Private Limited

500 SF or 20% of floor area



© Beyond Smart Cities Private Limited

Visual Lighting part 2,
Brightness
A narrative is provided that describes how light will be balanced between _____ and _____.



© Beyond Smart Cities Private Limited

adjacent and non-adjacent spaces
in the same room such as
main rooms and ancillary spaces
desk surface and computer screen
across a ceiling



© Beyond Smart Cities Private Limited

How many features in Fitness?
Preconditions?



© Beyond Smart Cities Private Limited

8 Total
Features #64-65 Preconditions (2)
#66-71 optimizations (6)



© Beyond Smart Cities Private Limited

Lack of activity can increase
stroke by ____% and reduce
life expectancy by ____ years.



© Beyond Smart Cities Private Limited

20-30%
3-5 years



© Beyond Smart Cities Private Limited

Lack of Exercise – How many
deaths worldwide per year? %
and #



© Beyond Smart Cities Private Limited

6-9% of all deaths
3-5 million



© Beyond Smart Cities Private Limited

Lack of Exercise =
____% of heart disease
____% of type 2 diabetes
____% breast and colon cancer



© Beyond Smart Cities Private Limited

30% of heart disease
27% of type 2 diabetes
21-25% breast and colon cancer



© Beyond Smart Cities Private Limited

Interior fitness circulation
(stairs)

In projects with 2 to 4 floors
stairs should be within ____ft
from entrance



© Beyond Smart Cities Private Limited

25ft



© Beyond Smart Cities Private Limited

Stairs should be at least
____wide, have
artwork/music/windows and
have light levels of at least
____lux



© Beyond Smart Cities Private Limited

56"
215 lux



© Beyond Smart Cities Private Limited

Activity Incentives
gym reimbursements - \$____
or more for every ____month
period where a person visits
50x (roughly 2x/week)



© Beyond Smart Cities Private Limited

\$200 every 6 months



© Beyond Smart Cities Private Limited

Activity incentives
group fitness/races/sports
teams fitness studio =
\$____/year



© Beyond Smart Cities Private Limited

\$240



© Beyond Smart Cities Private Limited

Activity incentives
bicycle share = \$____/year



© Beyond Smart Cities Private Limited

\$50



© Beyond Smart Cities Private Limited

Exercise ____hrs/day of can
reduce mortality by ____%



© Beyond Smart Cities Private Limited

2.5 hours/20%



© Beyond Smart Cities Private Limited

Structured Fitness
Opportunities (onsite
programs)
onsite fitness programs are
offered at least ____



© Beyond Smart Cities Private Limited

once a month.



© Beyond Smart Cities Private Limited

Exterior Active Design
(building walking routes)
If building takes up less than
____% of lot then offer at least
one of these 3____ and two
of these 4____



© Beyond Smart Cities Private Limited

75% -
1 - bench, movable chairs/tables,
drinking fountain
2 - water feature, plaza, garden, art



© Beyond Smart Cities Private Limited

Building should have a
neighborhood walk score of
_____ or greater



© Beyond Smart Cities Private Limited

70



© Beyond Smart Cities Private Limited

Physical Activity Spaces
(onsite)
needed for buildings with more
than _____ occupants
_____ SF space is needed



© Beyond Smart Cities Private Limited

+10 occupants
200 SF + ISF/person, up to 4000SF



© Beyond Smart Cities Private Limited

Physical Activity Spaces
(nearby)
within ____mi there should be
a ____ or access to ____.



© Beyond Smart Cities Private Limited

0.5 mile,
parks with trails or a gym, playing
field or pool



© Beyond Smart Cities Private Limited

Active transportation Support
(bike storage)
Within ____ft of entrance there
will be
bike storage for ____% of
occupants and ____% of
visitors



© Beyond Smart Cities Private Limited

650 ft
5% of occupants
2.5% visitors



© Beyond Smart Cities Private Limited

How many features in Fitness?
Preconditions?



© Beyond Smart Cities Private Limited

8 Total
Features #64-65 Preconditions (2)
#66-71 optimizations (6)



© Beyond Smart Cities Private Limited

Lack of activity can increase
stroke by ____% and reduce
life expectancy by ____ years.



© Beyond Smart Cities Private Limited

20-30%
3-5 years



© Beyond Smart Cities Private Limited

Lack of Exercise – How many
deaths worldwide per year? %
and #



© Beyond Smart Cities Private Limited

6-9% of all deaths
3-5 million



© Beyond Smart Cities Private Limited

Lack of Exercise =
____% of heart disease
____% of type 2 diabetes
____% breast and colon cancer



© Beyond Smart Cities Private Limited

30% of heart disease
27% of type 2 diabetes
21-25% breast and colon cancer



© Beyond Smart Cities Private Limited

**64 - interior fitness circulation
(stairs)**

In projects with 2 to 4 floors
stairs should be within ____ft
from entrance



© Beyond Smart Cities Private Limited

25ft



© Beyond Smart Cities Private Limited

Stairs should be at least
____wide, have
artwork/music/windows and
have light levels of at least
____lux



© Beyond Smart Cities Private Limited

56"
215 lux



© Beyond Smart Cities Private Limited

Activity Incentives
gym reimbursements - \$____
or more for every ____month
period where a person visits
50x (roughly 2x/week)



© Beyond Smart Cities Private Limited

\$200 every 6 months



© Beyond Smart Cities Private Limited

65 - Activity incentives
group fitness/races/sports
teamsfitness studio =
\$____/year



© Beyond Smart Cities Private Limited

\$240



© Beyond Smart Cities Private Limited

65 - Activity incentives
bicycle share = \$____/year



© Beyond Smart Cities Private Limited

\$50



© Beyond Smart Cities Private Limited

Exercise ____hrs/day of can
reduce motality by ____%



© Beyond Smart Cities Private Limited

2.5 hours/20%



© Beyond Smart Cities Private Limited

6 - Structured Fitness Opportunities (onsite programs)
onsite fitness programs are offered at least ____



© Beyond Smart Cities Private Limited

once a month.



© Beyond Smart Cities Private Limited

Exterior Active Design (building walking routes)
If building takes up less than ____% of lot then offer at least one of these 3____ and two of these 4____



© Beyond Smart Cities Private Limited

75% -
1 - bench, movable chairs/tables, drinking fountain
2 - water feature, plaza, garden, art



© Beyond Smart Cities Private Limited

Building should have a
neighborhood walk score of
____ or greater



© Beyond Smart Cities Private Limited

70



© Beyond Smart Cities Private Limited

Physical Activity Spaces
(onsite)
needed for buildings with more
than ____ occupants
____ SF space is needed



© Beyond Smart Cities Private Limited

+10 occupants
200 SF + ISF/person, up to 4000SF



© Beyond Smart Cities Private Limited

Physical Activity Spaces
(nearby)
within ____mi there should be
a ____ or access to ____.



© Beyond Smart Cities Private Limited

0.5 mile,
parks with trails or a gym, playing
field or pool



© Beyond Smart Cities Private Limited

Active transportation Support
(bike storage)
Within ____ft of entrance there
will be
bike storage for ____% of
occupants and ____% of
visitors



© Beyond Smart Cities Private Limited

650 ft
5% of occupants
2.5% visitors



© Beyond Smart Cities Private Limited

How many features in Comfort?



© Beyond Smart Cities Private Limited

12 features (#72-83)
5 preconditions (72-76)
7 Optimizations (77-83)



© Beyond Smart Cities Private Limited

How many American have
Lower back pain?



© Beyond Smart Cities Private Limited

31 million



© Beyond Smart Cities Private Limited

Leading source of
dissatisfaction with office
conditions?



© Beyond Smart Cities Private Limited

acoustic problems



© Beyond Smart Cities Private Limited

How many people worldwide
have Lower back pain?



© Beyond Smart Cities Private Limited

7% of population



© Beyond Smart Cities Private Limited

Total # of days of work missed
due to MSDs (musculoskeletal
disorders) - back pain, neck
pain, osteoarthritis, carpal
tunnel etc.



© Beyond Smart Cities Private Limited

380,600 days
makes up 1/3 of total days absent



© Beyond Smart Cities Private Limited

Thermal comfort - only ____%
of buildings met occupant
satisfaction



© Beyond Smart Cities Private Limited

11%



© Beyond Smart Cities Private Limited

Ergonomics (prerequisite)
all computer screens are
adjustable plus,
____% of workstations change
from sit to stand, and chair
height and seat depth are
adjustable and compliant with

_____.



© Beyond Smart Cities Private Limited

30%
HFES 100 or BIFMA GI



© Beyond Smart Cities Private Limited

Exterior Noise Intrusion
traffic noise increases risk for 4
things ____.



© Beyond Smart Cities Private Limited

diabetes
stroke
heart attack
hypertension



© Beyond Smart Cities Private Limited

Exterior Noise Intrusion
Within 1 hour of normal
business hours sound intrusion
does not exceed ____ dBA



© Beyond Smart Cities Private Limited

50 dBA



© Beyond Smart Cities Private Limited

How is Exterior Noise Verified?



© Beyond Smart Cities Private Limited

Well Assessor does a Performance
Test



© Beyond Smart Cities Private Limited

75 - Internally Generated
Noise
Acoustic Plan identifies _____
and _____.



© Beyond Smart Cities Private Limited

loud and quiet zones
and
noisy equipment



© Beyond Smart Cities Private Limited

Noise Criteria - max noise from
HVAC in spaces:

Teleconference rooms _ _ _ _

Conference Rooms _ _ _ _

Enclosed Offices _ _ _ _

Open Offices _ _ _ _ _



© Beyond Smart Cities Private Limited

Noise Criteria - max noise in
spaces:

Teleconference rooms - 20 NC

Conference Rooms - 30 NC

Enclosed Offices - 35 NC

Open Offices - 40 NC



© Beyond Smart Cities Private Limited

76 - Thermal Comfort Part 1
Mechanically ventilated
projects must meet criteria
under _____.



© Beyond Smart Cities Private Limited

ASHRAE 55-2013 section 5.3
Standard Comfort Zone compliance



© Beyond Smart Cities Private Limited

76 - Thermal Comfort Part 2
Naturally ventilated projects
must meet criteria under
_____.



© Beyond Smart Cities Private Limited

ASHRAE 55-2013 section 5.4
Adaptive Comfort Model



© Beyond Smart Cities Private Limited

What is Homeothermy?



© Beyond Smart Cities Private Limited

balancing of heat gain and loss to
regulate core temp between 97-100



© Beyond Smart Cities Private Limited

Olfactory Comfort (keep interiors odorless)

Source separation - all
restrooms, janitorial closets,
kitchens, cafeterias and pantries
use these 5 methods to keep
odors from migrating:



© Beyond Smart Cities Private Limited

1. negative pressurization
2. interstitial rooms
3. vestibules
4. hallways
5. self-closing doors



© Beyond Smart Cities Private Limited

What role does the
neurotransmitter Serotonin
play?



© Beyond Smart Cities Private Limited

exercise increases it, and Serotonin
can elevate mood and regulate
sleep cycle.



© Beyond Smart Cities Private Limited

How much does mental illness
shorten life span?



© Beyond Smart Cities Private Limited

10 years



© Beyond Smart Cities Private Limited

**How many adults in the US
suffer major depression?**



© Beyond Smart Cities Private Limited

16 million



© Beyond Smart Cities Private Limited

**How many deaths are
attributed to mental disorders
each year?**



© Beyond Smart Cities Private Limited

8 million or 14% of all deaths



© Beyond Smart Cities Private Limited

Chronic stress and anxiety can
lead to these 4 health risks:



© Beyond Smart Cities Private Limited

metabolic syndrome
cardiovascular disease
gastrointestinal disorders
acne & psoriasis



© Beyond Smart Cities Private Limited

How many features in Mind?



© Beyond Smart Cities Private Limited

17 features (#84-100)
5 preconditions (#84-88)



© Beyond Smart Cities Private Limited

what are the numbers to
remember for the
preconditions of all 7 concepts?



© Beyond Smart Cities Private Limited

12-34-45-56-65-76-88



© Beyond Smart Cities Private Limited

Health and Wellness
Awareness (Literature)
each certified building shall
have onhand a library (digital
or physical) containing ____,
and ____



© Beyond Smart Cities Private Limited

- at least one book or magazine
for every 20 occupants (up to
20 titles)
- a guide explaining how the
project met WELL features



© Beyond Smart Cities Private Limited

Integrative Design

What three phases are part of the collaborative process?



© Beyond Smart Cities Private Limited

- 1 - stakeholder charrette
- 2 - development plan
- 3 - stakeholder orientation upon completion (building tour)



© Beyond Smart Cities Private Limited

Integrative Design (Health mission)

What 4 parts are included in the Development Plan?



© Beyond Smart Cities Private Limited

- 1 - site selection/public transportation
- 2 - WELL concepts
- 3 - plans for implementation
- 4 - operations and maintenance plans



© Beyond Smart Cities Private Limited

Post-Occupancy Surveys
Sample size - how many
employees, how often?



© Beyond Smart Cities Private Limited

30%
at least once per year



© Beyond Smart Cities Private Limited

What standard is used to
develop the occupant survey?



© Beyond Smart Cities Private Limited

Occupant Indoor Environmental
Quality (IEQ) from UC Berkeley



© Beyond Smart Cities Private Limited

86 - IEQ Survey Content
Buildings with ____ or more
employees
covering which 7 topics?



© Beyond Smart Cities Private Limited

10 employees

1. acoustics
2. thermal comfort
3. furnishings
4. light levels/quality
5. odors
6. cleanliness/maint
7. layout



© Beyond Smart Cities Private Limited

surveys -
results should be sent to which
3 groups within 30 days?



© Beyond Smart Cities Private Limited

owners and managers, occupants,
IWBI



© Beyond Smart Cities Private Limited

Beauty and Design I to create
calm/improve mood
What are 5 features to
incorporate?



© Beyond Smart Cities Private Limited

human delight
celebration of culture, spirit, and
place
public art



© Beyond Smart Cities Private Limited

Biophilia I - Qualitative
(prerequisite)
what are the three parts?



© Beyond Smart Cities Private Limited

1 - nature incorporation
2 - pattern incorporation
3 - nature interaction



© Beyond Smart Cities Private Limited

How many dwellings in a single building w/ common structural elements are required to be considered Multifamily Residential?



© Beyond Smart Cities Private Limited

5



© Beyond Smart Cities Private Limited

Feature 01 Air Quality Standards: T/F this feature requires an assessor to complete a performance test after occupancy.



© Beyond Smart Cities Private Limited

True



© Beyond Smart Cities Private Limited

These 2 particles make up a large proportion of dust that can be drawn deep into the lungs. Larger particles tend to be trapped in nose, mouth, or throat.



© Beyond Smart Cities Private Limited

PM10 and PM2.5



© Beyond Smart Cities Private Limited

How large are PM10 and PM2.5 particles?



© Beyond Smart Cities Private Limited

PM10 $\leq$ 10 micrometers
PM2.5 $\leq$ 2.5 micrometers



© Beyond Smart Cities Private Limited

The average life expectancy of
a smoker is X years less than
that of a non-smoker.



© Beyond Smart Cities Private Limited

10



© Beyond Smart Cities Private Limited

The levels of this airborne
pollutant serve as a proxy for
other INDOOR pollutants.



© Beyond Smart Cities Private Limited

Carbon Dioxide



© Beyond Smart Cities Private Limited

What documentation is
required for Feature 03
Ventilation Effectiveness?



© Beyond Smart Cities Private Limited

LOA from MEC engineer &
Commissioning Report



© Beyond Smart Cities Private Limited

Benzene and formaldehyde are
considered what type of
compound?



© Beyond Smart Cities Private Limited

VOC



© Beyond Smart Cities Private Limited

How many times higher can
VOC levels be indoors than
outdoors?



© Beyond Smart Cities Private Limited

5x



© Beyond Smart Cities Private Limited

What documentation is
required for Feature 04 VOC
Reduction?



© Beyond Smart Cities Private Limited

LOA from architect and contractor



© Beyond Smart Cities Private Limited

What type of filters are designed to absorb VOCs and remove the largest particles?



© Beyond Smart Cities Private Limited

Carbon filters



© Beyond Smart Cities Private Limited

This type of filter is meant to remove smaller particles.



© Beyond Smart Cities Private Limited

Media filter (i.e. MERV 13). The higher the MERV #, the smaller the particle it removes.



© Beyond Smart Cities Private Limited

**What documentation is
required for Feature 05 Air
Filtration?**



© Beyond Smart Cities Private Limited

**For parts 1 & 2 Filter
Accommodation & Particle Filtration
= LOA from MEP Engineer & Spot
Check
Part 3 Air Filtration Maintenance =
operations schedule**



© Beyond Smart Cities Private Limited

**ultraviolet germicidal
irradiation (UVGI)**



© Beyond Smart Cities Private Limited

**A sterilisation method that uses UV
light to break down microorganisms
by destroying their DNA. Often used
in food, air, and water purification.**



**Destroys bacteria, virus, and mould
spores.**

© Beyond Smart Cities Private Limited

**What documentation is
required for Feature 07
Construction Pollution
Management?**



© Beyond Smart Cities Private Limited

LOA from Contractor



© Beyond Smart Cities Private Limited

**What 5 items should the
Feature 09 Cleaning Protocol
document address?**



© Beyond Smart Cities Private Limited

- 1. Frequency**
- 2. Procedures**
- 3. Equipment**
- 4. Supplies**
- 5. Training to improve cleaning regimens**



© Beyond Smart Cities Private Limited

What is Atrazine?



© Beyond Smart Cities Private Limited

One of the most widely used pesticides, and a suspected endocrine disruptor associated with cardiovascular problems.



© Beyond Smart Cities Private Limited

Long-term exposure to this widely used herbicide may lead to kidney and reproductive problems.



© Beyond Smart Cities Private Limited

Glyphosate



© Beyond Smart Cities Private Limited

Exposure to asbestos can occur
how?



© Beyond Smart Cities Private Limited

Via inhalation when building
materials degrade over time or are
disturbed during
renovation/construction.



© Beyond Smart Cities Private Limited

Asbestos is associated with
what 2 diseases?



© Beyond Smart Cities Private Limited

Mesothelioma
Lung Cancer



© Beyond Smart Cities Private Limited

What effects can lead exposure have?



© Beyond Smart Cities Private Limited

Neurotoxic effects.
In early development it's associated
with negative effects on memory,
IQ, learning, and behaviour.



© Beyond Smart Cities Private Limited

In what 4 ways can moisture
enter buildings and building
assemblies?



© Beyond Smart Cities Private Limited

1. Bulk water
2. Capillary water
3. Air-transported moisture
4. Vapour diffusion



© Beyond Smart Cities Private Limited

Why should management of construction pollution be a first priority?



© Beyond Smart Cities Private Limited

Due to the time required to conduct a flush.



© Beyond Smart Cities Private Limited

What documentation is required for Feature 14 Air Infiltration Management?



© Beyond Smart Cities Private Limited

**Annotated Document:
Commissioning Report (this feature r/t checking for air leakages in the building envelope)**



© Beyond Smart Cities Private Limited

What are the potential dangers
of high humidity?



© Beyond Smart Cities Private Limited

High humidity may promote the
accumulation of growth of microbial
pathogens, such as:
bacteria
dust mites
mould



© Beyond Smart Cities Private Limited

An increase in relative humidity
of 35% can increase the
emissions of formaldehyde by
what factor?



© Beyond Smart Cities Private Limited

In arid environments because it
doesn't further dry out the air.



© Beyond Smart Cities Private Limited

What pollutants can copy
rooms contribute to?



© Beyond Smart Cities Private Limited

Ozone



© Beyond Smart Cities Private Limited

What effect can ozone have on
human health?



© Beyond Smart Cities Private Limited

It's linked to asthma and other
respiratory diseases.
Destroys bacteria, virus, and mould
spores.



© Beyond Smart Cities Private Limited

**To whom are air quality metrics
data reported to?**



© Beyond Smart Cities Private Limited

Building occupants and the IWBI



© Beyond Smart Cities Private Limited

**What must be analysed prior
to integrating operable
windows into the design?**



© Beyond Smart Cities Private Limited

**Annual prevailing breeze patterns
and average contaminant levels**



© Beyond Smart Cities Private Limited

Up to 60% of people with asthma who live in urban environments also have a sensitivity to the allergens of what pest?



© Beyond Smart Cities Private Limited

Cockroach



© Beyond Smart Cities Private Limited

The bodies, feces, and saliva of dust mites can trigger what?



© Beyond Smart Cities Private Limited

Parts 1 & 2 Carbon Filtration and Air Sanitization = LOA from MEP Engineer & Spot Check
Part 3 Air Quality Maintenance = Operations Schedule



© Beyond Smart Cities Private Limited

What has 210x the binding affinity for hemoglobin compared to oxygen?



© Beyond Smart Cities Private Limited

Carbon Monoxide



© Beyond Smart Cities Private Limited

What is a lack of oxygen delivery to body tissues?



© Beyond Smart Cities Private Limited

Hypoxia
Destroys bacteria, virus, and mould spores.



© Beyond Smart Cities Private Limited

What effects can hypoxia
cause?



© Beyond Smart Cities Private Limited

nausea, altered LOC, death



© Beyond Smart Cities Private Limited

What does short wavelength
UV light (UV-C) do?



© Beyond Smart Cities Private Limited

It can reduce the bacterial load on
surfaces.



© Beyond Smart Cities Private Limited

Turbidity



© Beyond Smart Cities Private Limited

The cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of water quality



© Beyond Smart Cities Private Limited

Removing turbidity improves water how?



© Beyond Smart Cities Private Limited

By also removing harmful pathogens such as protozoa.



© Beyond Smart Cities Private Limited

The presence of coliforms in water suggests what?



© Beyond Smart Cities Private Limited

That the water may contain more dangerous pathogens, including: bacteria, viruses, and protozoa.



© Beyond Smart Cities Private Limited

How does exposure to waterborne pathogens such as bacteria, viruses, and protozoa affect human health?



© Beyond Smart Cities Private Limited

Exposure can lead to adverse gastrointestinal effects such as diarrhea, vomiting, nausea, and cramps.



© Beyond Smart Cities Private Limited

**What 2 types of water filters
can remove dissolved metals?**



© Beyond Smart Cities Private Limited

**Reverse Osmosis (RO)
Kinetic Degradation Fluxion (KDF)**



© Beyond Smart Cities Private Limited

**Exposure to even minute
amounts of mercury and lead
has been linked to what?**



© Beyond Smart Cities Private Limited

**Developmental delays & deficits in
learning abilities in children
High BP & kidney problems in adults**



© Beyond Smart Cities Private Limited

Activated carbon filters are
effective in removing what
from water?



© Beyond Smart Cities Private Limited

Polychlorinated biphenyls (PCBs)
Benzene
Styrene
other organic contaminants & VOCs



© Beyond Smart Cities Private Limited

Exposure to organic
contaminants such as PCBs
and vinyl chloride in drinking
water has been associated with
what ailments?



© Beyond Smart Cities Private Limited

Cancer
Immune deficiencies
Nervous system difficulties



© Beyond Smart Cities Private Limited

Fluorosis



© Beyond Smart Cities Private Limited

Aesthetic mottling of teeth caused by excessive exposure to fluorine compounds.



© Beyond Smart Cities Private Limited

What are Chlorine and Chloramine?



© Beyond Smart Cities Private Limited

Compounds that may be added to water to act as disinfectants and can lead to the formation of disinfectant byproduct such as trihalomethanes (THMs), haloacetic acids (HAAs), as well as N-nitrosodimethylamine (NDMA) which can cause cancer.



© Beyond Smart Cities Private Limited

What affects the rate at which
inorganic metals leach into
drinking water sources?



© Beyond Smart Cities Private Limited

1. Changing industrial practices
2. Temporal variations in temperature
3. pH
4. Weather



© Beyond Smart Cities Private Limited

What 3 technologies are used
to maintain high water quality?



© Beyond Smart Cities Private Limited

1. Carbon filters
2. Sediment filters
3. UV sanitisation



© Beyond Smart Cities Private Limited

What documentation is
required for Feature 37:
Drinking Water Promotion?



© Beyond Smart Cities Private Limited

LOA from architect and on-site spot
check



© Beyond Smart Cities Private Limited

What's the recommended
number of fruit and veg per
day?



© Beyond Smart Cities Private Limited

4 servings of fruit
5 servings of vegetables



© Beyond Smart Cities Private Limited

Insufficient fruit and veg intake
is one of the top 10 risk factors
contributing to what?



© Beyond Smart Cities Private Limited

Global mortality, leading to
approximately 2.7 million deaths
worldwide.



© Beyond Smart Cities Private Limited

What is the recommended
daily sugar limit?



© Beyond Smart Cities Private Limited

6-9 teaspoons per day



© Beyond Smart Cities Private Limited

**What is the most effective way
to remove bacteria when
drying hands?**



© Beyond Smart Cities Private Limited

Paper towels



© Beyond Smart Cities Private Limited

**What documentation is
required for Feature 43
Artificial Ingredients?**



© Beyond Smart Cities Private Limited

**Operations schedule and on-site
spot check.**



© Beyond Smart Cities Private Limited

What is Bisphenol-A (BPA)?



© Beyond Smart Cities Private Limited

A phenolic-based chemical that is used in plastic products (baby/water bottles, foodware, food can linings). It can be released when exposed to HEAT or UV LIGHT, and may have negative effects on human health.



© Beyond Smart Cities Private Limited

What ambient light level is sufficient for most tasks?



© Beyond Smart Cities Private Limited

300 lux



© Beyond Smart Cities Private Limited

What are the main
photoreceptors for daytime
vision?



© Beyond Smart Cities Private Limited

Cones



© Beyond Smart Cities Private Limited

Where are cones located within
the eye?



© Beyond Smart Cities Private Limited

On the retina.



© Beyond Smart Cities Private Limited

Photosensitive retinal ganglion cells (ipRGCs)



© Beyond Smart Cities Private Limited

The eyes' non-image-forming photoreceptors. Bright light hits these and signals are sent to the suprachiasmatic nucleus to promote alertness. Lack of light stimulus here signals the body to reduce energy expenditure and prepare for rest.
teal-blue 480



© Beyond Smart Cities Private Limited

Equivalent Melanopic Lux (EML)



© Beyond Smart Cities Private Limited

A measure of light's effects on the circadian cycle and determines how interior lighting can support circadian function.
 $EML = \text{visual lux (L)} \times \text{melanopic ratio (R)}$ for a given light source.



© Beyond Smart Cities Private Limited

Which light sources will
produce more EML?



© Beyond Smart Cities Private Limited

Light sources with an appearance
closer to daylight (i.e. "cooler" blue
lights). 5000-6500 K



© Beyond Smart Cities Private Limited

2.5hrs of moderate-intensity
physical activity per week can
reduce overall mortality risk by
what percent?



© Beyond Smart Cities Private Limited

20%



© Beyond Smart Cities Private Limited

Sitting more than 3 hours/day
is associated with X years lower
life expectancy.



© Beyond Smart Cities Private Limited

2 years



© Beyond Smart Cities Private Limited

Standing burns how many
more calories per hour than
sitting?



© Beyond Smart Cities Private Limited

50



© Beyond Smart Cities Private Limited

How does the CDC define fitness?



© Beyond Smart Cities Private Limited

The ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and respond to emergencies.



© Beyond Smart Cities Private Limited

How many activities per week should adults engage in?



© Beyond Smart Cities Private Limited

30 min moderate-intensity aerobic activity 5 days/week.
Muscle strengthening activity 2 days/week.



© Beyond Smart Cities Private Limited

How much moderate to
vigorous activity does the
average adult get per day?



© Beyond Smart Cities Private Limited

6-10 minutes



© Beyond Smart Cities Private Limited

30% of ischemic heart disease,
27% of Type II Diabetes, and
21-25% of breast and colon
cancer is caused by what?



© Beyond Smart Cities Private Limited

Physical inactivity



© Beyond Smart Cities Private Limited

The 4th leading risk factor for mortality, accounting for 6-9% of deaths worldwide.



© Beyond Smart Cities Private Limited

Physical inactivity



© Beyond Smart Cities Private Limited

What is the correlation between physical inactivity and stroke?



© Beyond Smart Cities Private Limited

Physical inactivity can increase the odds of having a stroke by 20-30% and shave off 3-5 years of life.



© Beyond Smart Cities Private Limited

Define rods, cones, and ipRGCs



© Beyond Smart Cities Private Limited

Rods: peripheral vision, and vision in dim lighting. Peak sensitivity to green-blue light (498 nm)

Cones: Daytime vision and colour perception. Peak sensitivity to green-yellow light (555 nm)

ipRGCs: critical to circadian rhythm. Peak sensitivity to teal-blue light (480 nm). ipRGCs send info to the suprachiasmatic nucleus to let it know the time of day based on light received.



© Beyond Smart Cities Private Limited

Briefly explain how vision works.



© Beyond Smart Cities Private Limited

Light enters the eye and hits photoreceptors on the retina: rods, cones, and intrinsically photosensitive retinal ganglion cells (ipRGCs)



© Beyond Smart Cities Private Limited

Suprachiasmatic nucleus



© Beyond Smart Cities Private Limited

The location of the main mammalian 24-hr circadian clock that acts as an oscillator to synchronise clocks in peripheral tissues and organs. Gets its info from the amount of light received by the ipRGCs.



© Beyond Smart Cities Private Limited

Zeitgebers



© Beyond Smart Cities Private Limited

External cues that align physiological functions to the solar cycle and cue the circadian rhythm.



© Beyond Smart Cities Private Limited

What is the most important
zeitgeber?



© Beyond Smart Cities Private Limited

Light is the most important
zeitgeber. It keeps the body's
internal clocks synchronised in a
process known as circadian
photoentrainment.



© Beyond Smart Cities Private Limited

Circadian photoentrainment



© Beyond Smart Cities Private Limited

The process by which light keeps the
body's internal clocks synchronised.
All light, not just sunlight can
contribute to circadian
photoentrainment.



© Beyond Smart Cities Private Limited

The peak sensitivity for the sensation of brightness occurs at what light colour?



© Beyond Smart Cities Private Limited

Green-yellow light



© Beyond Smart Cities Private Limited

What is the difference between UV light and infrared light?



© Beyond Smart Cities Private Limited

UV = smaller wavelengths
Infrared = larger wavelengths



© Beyond Smart Cities Private Limited

What health issues are
associated with chronic sleep
deprivation?



© Beyond Smart Cities Private Limited

Diabetes
Obesity
Depression
Heart attack
Hypertension
Stroke



© Beyond Smart Cities Private Limited

What effect does light
exposure have on circadian
rhythms?



© Beyond Smart Cities Private Limited

Light exposure in late night/early
morning = shift rhythms forward
(phase advance)
Light exposure in late afternoon =
shift rhythms back (phase delay)



© Beyond Smart Cities Private Limited

In general, what does WELL advocate for light levels? (in colour and K)



© Beyond Smart Cities Private Limited

WELL advocates for lights that are closer to natural daylight's cool/blue temperature colour spectrum (because they have a greater EML and thus have greater impact on circadian cycle). Lamps with 5000 - 6500 Kelvin during daytime hours.



© Beyond Smart Cities Private Limited

What BMI values indicate overweight and obese?



© Beyond Smart Cities Private Limited

25-29.9 = overweight
30+ = obese



© Beyond Smart Cities Private Limited

High consumption of sugar
sweetened beverages is linked
to what diseases?



© Beyond Smart Cities Private Limited

Diabetes
Metabolic Syndrome
Obesity
Hypertension
Dental caries
Depression



© Beyond Smart Cities Private Limited

High intake of red and
processed meat is associated
with what diseases?



© Beyond Smart Cities Private Limited

Heart failure
Hypertension
Heart disease
Colorectal & breast cancers



© Beyond Smart Cities Private Limited

Low fruit and veg consumption
is associated with what
diseases?



© Beyond Smart Cities Private Limited

Type II diabetes
Cardiovascular mortality
Breast and GI cancers



© Beyond Smart Cities Private Limited

How much of the body is
comprised of water?



© Beyond Smart Cities Private Limited

More than 2/3



© Beyond Smart Cities Private Limited

What is the recommended water intake from all sources for men and women from the Institute of Medicine (IOM)?



© Beyond Smart Cities Private Limited

Women = 2.7L
Men = 3.7L



© Beyond Smart Cities Private Limited

What is the #1 environmental cause of premature mortality, contributing to approx 7 million (1 in 8) deaths worldwide?



© Beyond Smart Cities Private Limited

Air pollution



© Beyond Smart Cities Private Limited

How much air does an average person breathe every day?



© Beyond Smart Cities Private Limited

15,000 L



© Beyond Smart Cities Private Limited

What can poor ventilation practices expose humans to?



© Beyond Smart Cities Private Limited

Volatile Organic Compounds
(VOCs)
Polycyclic Aromatic Hydrocarbons
(PAH)
Microbial Pathogens



© Beyond Smart Cities Private Limited

What 6 major air pollutants
does WELL address?



© Beyond Smart Cities Private Limited

1. Nitrogen dioxide
2. Carbon monoxide
3. Lead
4. Ozone
5. Particulate Matter (PM10, PM2.5)
6. Sulfur Dioxide



© Beyond Smart Cities Private Limited

What is the leading source of
dissatisfaction within the
environmental conditions of an
office?



© Beyond Smart Cities Private Limited

Acoustical problems



© Beyond Smart Cities Private Limited

What effect does light exposure have on circadian rhythms?



© Beyond Smart Cities Private Limited

Light exposure in late night/early morning = shift rhythms forward (phase advance)
Light exposure in late afternoon = shift rhythms back (phase delay)



© Beyond Smart Cities Private Limited

In general, what does WELL advocate for light levels? (in colour and K)



© Beyond Smart Cities Private Limited

WELL advocates for lights that are closer to natural daylight's cool/blue temperature colour spectrum (because they have a greater EML and thus have greater impact on circadian cycle). Lamps with 5000 - 6500 Kelvin during daytime hours.



© Beyond Smart Cities Private Limited

High intake of red and
processed meat is associated
with what diseases?



© Beyond Smart Cities Private Limited

Heart failure
Hypertension
Heart disease
Colorectal & breast cancers



© Beyond Smart Cities Private Limited

Low fruit and veg consumption
is associated with what
diseases?



© Beyond Smart Cities Private Limited

Type II diabetes
Cardiovascular mortality
Breast and GI cancers



© Beyond Smart Cities Private Limited

What can poor ventilation practices expose humans to?



© Beyond Smart Cities Private Limited

Volatile Organic Compounds
(VOCs)
Polycyclic Aromatic Hydrocarbons
(PAH)
Microbial Pathogens



© Beyond Smart Cities Private Limited

7% (more than 169 million) of
all disability-adjusted-life-
years (DALYs) resulted from
what disorder?



© Beyond Smart Cities Private Limited

Musculoskeletal disorders



© Beyond Smart Cities Private Limited

What is Reverberation Time (RT60)?



© Beyond Smart Cities Private Limited

RT = Reverberation time. The time it takes for sound to decay.
RT60 = Most common RT used. The time it takes for sound level to decay by 60dB. Rooms with high RT may have echos, take a long time for sounds like footsteps to dissipate - can make it difficult to hear speech.



© Beyond Smart Cities Private Limited

Noise Reduction Coefficient (NRC)



© Beyond Smart Cities Private Limited

An average value that determines the absorptive properties of materials. The larger the NRC value, the better the material is at absorbing sound. #80- Sound Reducing Surfaces



© Beyond Smart Cities Private Limited

What are the benefits of a
radiant temperature system?



© Beyond Smart Cities Private Limited

Saved floor space
Lower dust transportation
Increased thermal comfort through
the separation of temperature
controls and fresh air supply



© Beyond Smart Cities Private Limited

What chemical is released by
exercise?



© Beyond Smart Cities Private Limited

Serotonin - can elevate mood and
regulate sleep cycle



© Beyond Smart Cities Private Limited

Depression is linked to what health problems?



© Beyond Smart Cities Private Limited

Most common mood disorder, associated with higher risk of heart disease and immunosuppression.



© Beyond Smart Cities Private Limited

How does mental illness impact life expectancy?



© Beyond Smart Cities Private Limited

Life expectancy among those with mental illness is more than 10 years shorter than those without, and more than 14%, or 8 million deaths each year are attributed to mental disorders.



© Beyond Smart Cities Private Limited

What documentation is
required for Feature 86: Post-
Occupancy Surveys?



© Beyond Smart Cities Private Limited

Policy document (annotated
document)



© Beyond Smart Cities Private Limited

Beauty and Biophilia primarily
impact which body system?



© Beyond Smart Cities Private Limited

Nervous system



© Beyond Smart Cities Private Limited

What biomarkers must the
self-monitoring device in
Feature 94: Self-Monitoring
track?



© Beyond Smart Cities Private Limited

At least 2 of the following:
Body weight/mass
Activity and steps
Heart rate variability
Sleep duration, quality, & regularity



© Beyond Smart Cities Private Limited

Organisations that espouse
fair, equitable, and just
treatment (transparency)
toward their workforce improve
their work environment how?



© Beyond Smart Cities Private Limited

- Create a culture of reduced stress
- Greater employee satisfaction
- Heightened sense of loyalty



© Beyond Smart Cities Private Limited

How do levels of perceived justice effect staff health?



© Beyond Smart Cities Private Limited

High levels of perceived justice at work are correlated with lower risk of poor health, whereas declining levels of perceived justice can in turn increase such risk.



© Beyond Smart Cities Private Limited

Alternative Adherence Path
(AAP)



© Beyond Smart Cities Private Limited

Alternative solution for meeting the intent of a WELL feature requirement. Fees apply.
MUST MEET INTENT OF FEATURE!



© Beyond Smart Cities Private Limited

Alveoli



© Beyond Smart Cities Private Limited

Small thin-walled air-containing compartments of the lung that are typically arranged in clusters that give the tissue a honeycomb appearance and expand its surface area for the purpose of oxygen exchange



© Beyond Smart Cities Private Limited

Explain colour temperature



© Beyond Smart Cities Private Limited

A way to describe light appearance. It's measured in degrees of Kelvin (K) on a scale from 1,000 - 10,000.

Cool colour levels give off blue-white light that mimics daylight = >4500K
Levels closest to daylight temperature colour = 5000 - 6500



© Beyond Smart Cities Private Limited

Curative Action Plan



© Beyond Smart Cities Private Limited

Doc that outlines strategies that project teams will employ to address any unmet criteria as identified in a WELL report. These must be submitted to the IWBI within 180 days of receiving the WELL report, and must detail a specific and feasible plan of action



© Beyond Smart Cities Private Limited

Innovation Features



© Beyond Smart Cities Private Limited

Features I01 & I02 which allow for project teams to submit ideas for new features under a certain concept. They must address an aspect relevant to the concept, with robust supporting literature from health and medical research.



© Beyond Smart Cities Private Limited

Metabolic Syndrome



© Beyond Smart Cities Private Limited

A cluster of medical conditions or risk factors that increase the chances of developing cardiovascular disease, diabetes fatty liver disease, and several cancers.



© Beyond Smart Cities Private Limited

WELL Assessor



© Beyond Smart Cities Private Limited

An independent professional who conducts on-site performance tests, inspections, and spot checks, as well as documentation review in order to evaluate a project's eligibility for WELL Certification, or WELL Core & Shell Compliance. WELL Assessor CANNOT serve as Project Administrator for the same project.



© Beyond Smart Cities Private Limited

Performance Verification



© Beyond Smart Cities Private Limited

A site visit where a WELL Assessor conducts performance tests, visual inspections, and spot-checks, and also includes follow-up analysis of collected data and samples.



© Beyond Smart Cities Private Limited

Sick Building Syndrome (SBS)



© Beyond Smart Cities Private Limited

An illness where no disease or cause can be identified, yet acute health effects are linked to time spent in a building. Symptoms are nonspecific and include eye, skin, and airway irritation, as well as headache and fatigue.



© Beyond Smart Cities Private Limited

Ultraviolet Germicidal Irradiation (UVG)



© Beyond Smart Cities Private Limited

Sterilisation method that uses UV light to break down microorganisms by destroying their DNA. Often used in food, air, and water purification.



© Beyond Smart Cities Private Limited

What are the 3 project typologies?



© Beyond Smart Cities Private Limited

New and Existing Buildings
Certification
New and Existing Interiors
Certification
Core and Shell Compliance



© Beyond Smart Cities Private Limited

**What projects does the
typology New and Existing
Buildings apply to?**



© Beyond Smart Cities Private Limited

**Applies to new and existing
buildings and addresses the full
scope of project design and
construction as well as building
operations. Relevant for office
buildings where a minimum of 90%
total floor area is occupied and
managed by the building owner.**



© Beyond Smart Cities Private Limited

**What projects does the
typology New and Existing
Interiors apply to?**



© Beyond Smart Cities Private Limited

**Office projects which only occupy a
portion of the space in a building, or
those that occupy an entire existing
building not undergoing a major
renovation.**



© Beyond Smart Cities Private Limited

What projects does the
typology Core and Shell
Compliance apply to?



© Beyond Smart Cities Private Limited

Office building projects seeking to implement fundamental features into the entire base building for the benefit of future tenants. At least 30% of the space needs to have an expected use of office space. No matter what portion of the building will be used for office space, 100% of the building must adhere to the requirements of Core & Shell.



© Beyond Smart Cities Private Limited

What are the 4 steps of
Certification?



© Beyond Smart Cities Private Limited

1. Project Registration with IWBI
2. Documentation submission and review
3. Performance verification on-site (by assessor and third party)
4. Scoring/WELL Report



© Beyond Smart Cities Private Limited

What are the 3 types of documentation required for WELL features?



© Beyond Smart Cities Private Limited

Annotated Documents = i.e. drawings, operations schedules, policy documents, narratives.

Letters of Assurance (LOA) = from either architect, contractor, engineer.

General Documentation = i.e. lighting drawings, mechanical drawings



© Beyond Smart Cities Private Limited

Define "spot check"



© Beyond Smart Cities Private Limited

Different from "visual inspection" in that spot checks serve to merely support another form of documentation.



© Beyond Smart Cities Private Limited

Define NIC



© Beyond Smart Cities Private Limited

Noise Isolation Class. A field test that determines sound transmitting abilities of a WALL CONSTRUCTION.

Increased NIC = increased sound insulation. (i.e. better at reducing sound transmission between walls)

#81- Sound Barriers



© Beyond Smart Cities Private Limited

What is photocatalytic oxidation?



© Beyond Smart Cities Private Limited

A way of filtering RECIRCULATED AIR using a combination of UV rays w/ a TiO₂-coated filter.



© Beyond Smart Cities Private Limited

What are Carbon Filters and Activated Carbon Filters used for?



© Beyond Smart Cities Private Limited

Filtering air & water. Remove
organic compounds: VOCs, Ozone,
PCBs, vinyl chloride, glyphosate,
atrazine, LARGER PARTICLES.



© Beyond Smart Cities Private Limited

What are the minimum NIC values for: Enclosed Office Conference/Teleconference Room



© Beyond Smart Cities Private Limited

Enclosed Office: 35 if sound
masking present, 40 if no sound
masking.
Conference/Teleconference: 53 on
walls adjoining private offices, or
other conference/teleconference
rooms.



© Beyond Smart Cities Private Limited

What are the maximum NC
values for the following:
Open Office & Lobbies
Enclosed Office
Conference/Breakout Room
Teleconference Room



© Beyond Smart Cities Private Limited

Open Office & Lobbies = max 40 NC
Enclosed Offices = max NC 35
Conference/Breakout Room = max
NC 30 (25 recommended)
Teleconference Room = max NC 20



© Beyond Smart Cities Private Limited

Define Noise Criteria (NC)



© Beyond Smart Cities Private Limited

The sound pressure limits for a
room.



© Beyond Smart Cities Private Limited

Which features require UV
water purification?



© Beyond Smart Cities Private Limited

#6 - Microbe & Mould Control (UV
light on cooling coils & water pan)
#36 - Water Treatment
#100 - Biophilia II - Quantitative
(in the required water features -
indoor or outdoor water feature)



© Beyond Smart Cities Private Limited

What are the requirements of
adjustable height desks in both
the Comfort and Fitness
sections?



© Beyond Smart Cities Private Limited

Fitness #71 Active Furnishings: (O).
Min 60% desks are sit/stand.
Comfort #73 Ergonomics: Visual
and Physical (P). Min 30% desks
are sit/stand.



© Beyond Smart Cities Private Limited

How are light levels measured
for visual acuity vs.
circadian/melanopic effect?



© Beyond Smart Cities Private Limited

Visual Acuity = minimum 215 lux
measured on horizontal plane 30" aff.
(i.e. desk height)

Melanopic Light Intensity = min 250
equivalent EML @ 75% workstations
measured on vertical plane, facing
forward 4' aff (i.e. to mimic view of
user). This light level must be present
min 4hrs/day for every day of year



© Beyond Smart Cities Private Limited

What is the difference between
Daylight Glass and Vision
Glass, and what are their VT
(visible transmittance)
requirements?



© Beyond Smart Cities Private Limited

Daylight Glass = glass above 2.1m
(7'), VT of 60% or more

Vision Glass = glass below 2.1m, VT
of 50% or more



© Beyond Smart Cities Private Limited

What are the requirements
regarding window access with
respect to WELL?



© Beyond Smart Cities Private Limited

75% desks within 7.5m of
atrium/window with view to exterior.

95% desks within 12.5m of
atrium/window with view to exterior.



© Beyond Smart Cities Private Limited

Feature #35 Periodic Water
Quality Testing calls for q3
month testing for what
contaminants?



© Beyond Smart Cities Private Limited

Copper
Lead
Arsenic
Mercury



© Beyond Smart Cities Private Limited

**Feature #18 Air Quality
Monitoring and Feedback
monitors which 3 indoor
pollutants, and which 2 indoor
thermal values?**



© Beyond Smart Cities Private Limited

**Particle Count (PM 2.5, PM10)
Ozone
Carbon Dioxide
Temperature
Humidity**



© Beyond Smart Cities Private Limited

**Feature #51 Food Production
requires how much gardening
space?**



© Beyond Smart Cities Private Limited

**0.1m²/1ft² per occupant
(max 70m²/754ft²)**



© Beyond Smart Cities Private Limited

To accurately portray colours,
the Colour Rendering Index
(CRI), what are the levels
required for R1-R8 & R9?



© Beyond Smart Cities Private Limited

R1-R8 = 80% (or higher)
R9 = 50% (or higher)



© Beyond Smart Cities Private Limited

Feature #80 Sound Reducing
Surfaces applies to which
surfaces?



© Beyond Smart Cities Private Limited

Ceilings & Walls (& office cubicle partitions, if present)

Ceilings:

Open offices- min NRC 0.9 for entire surface

Conference/Teleconference- min NRC 0.8 on min 50% ceiling

Walls:

Open offices- min NRC 0.8 on min 25% walls

Enclosed offices/Conference/Teleconf- min NRC 0.8 on min
25%

Cubicle Partitions- min NRC 0.8 & 1.2m/48" high



© Beyond Smart Cities Private Limited

What outdoor air conditions
would require an alert to close
windows in Feature #19
Operable Windows?



© Beyond Smart Cities Private Limited

PM10 >50ug/m³
Ozone levels >51ppb
Temperature >8C above/below
indoor temp
Humidity >60%



© Beyond Smart Cities Private Limited

PBDEs (Polybrominated
Diphenyl Ethers) are a toxic
additive which increase what
quality in materials?



© Beyond Smart Cities Private Limited

Fire resistance



© Beyond Smart Cities Private Limited

What is the definition of a Health Product Declaration (HPD)?



© Beyond Smart Cities Private Limited

A standard format for reporting product content and associated health information for building products and materials.



© Beyond Smart Cities Private Limited

T/F:
An AAP proposal may be submitted for pre-approval either before or after project registration



© Beyond Smart Cities Private Limited

True



© Beyond Smart Cities Private Limited

What percentage of Americans are overweight?



© Beyond Smart Cities Private Limited

69% of American adults are overweight
(40% of adults worldwide are overweight)



© Beyond Smart Cities Private Limited

35% of American adults are obese.
(13% of adults worldwide are obese)

T or F:
Parking garages and lots are included in the area calculations for WELL Pilot projects.



© Beyond Smart Cities Private Limited

False



© Beyond Smart Cities Private Limited

Dry Bulb Temperature (DBT)



© Beyond Smart Cities Private Limited

Temperature of air measured by a thermometer freely exposed to the air but shielded from radiation and moisture, without accounting for humidity.

Usually thought of as air temperature and it is the true thermodynamic temperature.



© Beyond Smart Cities Private Limited

Which hormone plays a primary role in stress, increases blood sugar, suppresses the immune system and aids in protein, fat and carbohydrate metabolism while also undergoing diurnal variation, playing an important role in the sleep-wake cycle?



© Beyond Smart Cities Private Limited

Cortisol



© Beyond Smart Cities Private Limited