

Assembly Committee Document 7.5

Proposed Section 21.07.130C., *Tall Buildings*, amending and replacing the *Tall Buildings* section content as it appeared in Assembly Document 7.4.A.

May 6, 2010

C. Tall Buildings

This section addresses the effects of high rise buildings in Alaska's northern climate, including wind downdraft impacts on pedestrian comfort and safety, and sunlight shadowing impacts on the surrounding community. The requirements of this section apply to all high rise development.

1. Wind

High rise buildings, including additions or modifications, shall be designed so that wind speeds on sidewalks, walkways and other pedestrian spaces surrounding the building will remain within thresholds for outdoor comfort and safety.

a. Wind Speed Criteria

Acceptable wind speed thresholds for outdoor comfort and safety shall be specified in the Title 21 users guide, and based on the types of pedestrian activity anticipated to occur around the proposed building.

b. Method for Determining Wind Conditions

A wind study by a wind engineering/aerodynamics expert shall be used to forecast wind conditions and present wind control measures or design modifications as necessary to demonstrate that wind speeds will remain within the accepted thresholds.

2. Sunlight Shadowing

High rise buildings, including additions or modifications, shall be placed and designed to minimize shading of the following use types deemed sensitive to sunlight shadowing: residential uses and lots in a residential or RO district; elementary, middle and high schools in the PLI district; health care facilities in the PLI district; cemeteries; public parks; community gardens; botanical gardens; and commercial horticulture.

a. Sunlight Access Criteria

Acceptable thresholds of sunlight shadowing for the use types listed above shall be specified in the Title 21 users guide.

b. Method for Determining Shadowing Impacts

A shadow impact analysis study by a registered architect or landscape architect shall be used to forecast the spatial extent and hourly time periods of shadowing, and present design modifications as necessary to demonstrate that the sunlight shadowing will remain with accepted thresholds.

3. Exceptions

The Director may allow wind speeds to exceed accepted thresholds for comfort, and/or allow shadowing beyond the accepted minimum thresholds for sunlight access, if:

- a. The building avoids worsening pre-existing conditions;
- b. The impact will be insubstantial because of the limited location or time period in which the wind speed or sunlight shadowing threshold is exceeded; or
- c. It has been demonstrated that the proposed development conforms to the maximum extent feasible.

Title 21 Users Guide: Wind Comfort and Safety Criteria (DRAFT)

Comfort

Wind criteria for pedestrian comfort and safety are typically based on wind force (speed). To capture the effects of both average winds and peak gust speeds in measuring pedestrian comfort, measurements of wind speed use the *gust equivalent mean (GEM)* wind speed. GEM is the hourly mean wind speed adjusted to incorporate the effects of gusts on pedestrians. GEM is calculated as the greater of either (a) the mean speed, or (b) the gust speed divided by a gust factor. Typically a gust factor of 1.85 is used for wind comfort measurement.

Wind speed thresholds for comfort vary depending on the type of pedestrian activity. Lower wind speeds are needed in areas where people will sit, as compared with areas primarily for walking through. Table 1 provides GEM wind speed ranges considered tolerable for three categories of pedestrian activity: sitting, standing and walking.

Sitting: Wind speeds of 6 mph or less are needed for outdoor cafes or other spaces where people will sit and relax or engage in other optional activities for long periods of time. At 0-6 mph, a light breeze may be felt, but a person can read a newspaper without it blowing away.

Standing: Wind speeds of 9 mph or less are needed for people to comfortably stand for awhile, or sit at a bench for short periods, such as at a bus stop, or a bench along a sidewalk, or a primary entrance to a building. At wind speeds of 9 mph, leaves will rustle, however window shopping or lingering for limited periods should remain tolerable.

Walking: Wind speeds of up to 12 mph can lift leaves, move litter, disturb hair and make loose clothing flap, but remain tolerable for walking on sidewalks, across intersections, or movement in playing fields or other spaces where people will be active.

Uncomfortable: Wind speeds greater than 12 mph are considered as a nuisance or can be an impediment for walking and other activities. Dust and loose paper is raised, hair is disarranged.

Probability of Exceedance. Because it is not reasonable to expect wind conditions in a location to be comfortable 100% of the time, the wind comfort criteria in Table 1 employ the widely accepted allowance for threshold wind speeds to be exceeded 20% of the time. For example, as long as wind speeds in a location remain in the range of 0 – 6 mph for 80% or more of the time, such location would be rated by Table 1 as comfortable for sitting.

Table 1. Acceptable Wind Speed Thresholds by Pedestrian Comfort and Safety Category				
Sitting	Standing	Walking	Uncomfortable	Unsafe
GEM wind speeds of 0 – 6 mph for 80% or more of the time	GEM wind speeds of 0 – 9 mph for 80% or more of the time	GEM wind speed of 0 – 12 mph for 80% or more of the time	GEM wind speed exceeds 12 mph for more than 20% of the time	Gust speeds of 55+ mph > two events annually

Wind Safety

The last column of Table 1 addresses the wind safety category. Winds or wind gusts that are strong enough to blow people over are considered a safety hazard. Sources classify wind speeds above 45 mph as a strong gale, enough to blow people over depending on a variety of factors. Gust speeds in excess of 55 mph are “whole gale” speeds, and are likely to take a person off footing or balance. If such gust speeds exceed occur more than two times per year, then the chance of someone being injured becomes unacceptably high, according to the ASCE.

Wind Chill

The wind comfort threshold criteria measure only wind *force*. An evaluation of thermal effects would be more complex. For this reason, wind studies are not required to address the potential thermal effects on pedestrian comfort in the winter. However, on colder winter days, it is expected that wind chill will reduce people’s tolerance of wind. Literature warns that any increase in winter winds can have a negative impact on outdoor activity. One source suggests that the relative wind comfort rating for any given location may shift by one comfort category to the right on Table 1 for each subtraction of 40 degrees from a starting temperature of 50 degrees Fahrenheit. Therefore, designers and review bodies are encouraged ensure that, in the winter especially, wind speeds will, to the maximum extent feasible, remain within the wind speed thresholds established in Table 1.

Determining Local Wind Conditions

Long-term wind statistics from the nearest airport (e.g., International Airport, Elmendorf), or another nearby first order weather station with reliable wind records, must be used to predict the frequency distribution of mean wind speeds for each wind direction. Because prevailing winds differ seasonally, statistics need to be separated into summer and winter seasonal data.

The wind expert preparing a wind study may be able to estimate wind conditions around the proposed building by conducting simply a *screening-level wind assessment*. Unlike a full-blown *wind tunnel test*, a *screening-level assessment* is based on the wind consultant’s knowledge and experience and/or software programs that estimate potential wind comfort conditions around a generalized building form. The *screening-level wind assessment* may be able to conclude that conditions around the building will remain within comfort and safety thresholds.

However, if the assessment cannot clearly indicate wind speeds will remain within the comfort or safety criteria, or if it suggests that conceptual wind control measures or changes to the building shape may be needed, then the wind study should progress to a *wind tunnel test* using a scale model of the proposed building and all relevant surrounding structures and topography. The selection of wind speed sensor locations around the model building are chosen by the wind expert in consultation with the building design team and municipal staff, and should reflect the location of anticipated pedestrian activities (sitting, standing, and/or walking) near the building.

Table 2 shows an acceptable presentation of a wind study’s predictions for wind conditions. It provides comfort/safety ratings for each location around the building, in summer and winter.

Location	Season	Comfort Category					Safety Category	
		Sitting	Standing	Walking	Uncomfortable	Rating	Events	Rating
1	Summer	70	80	90	10	<i>Standing</i>	0	Safe
	Winter	50	70	80	20	<i>Walking</i>	1	Safe
2	Summer	75	85	90	10	<i>Standing</i>	2	Safe
	Winter	40	60	70	30	<i>Uncomf.</i>	4	Fail

**Title 21 Users Guide:
Acceptable Thresholds of Sunlight Shadowing by High Rise Buildings (DRAFT)**

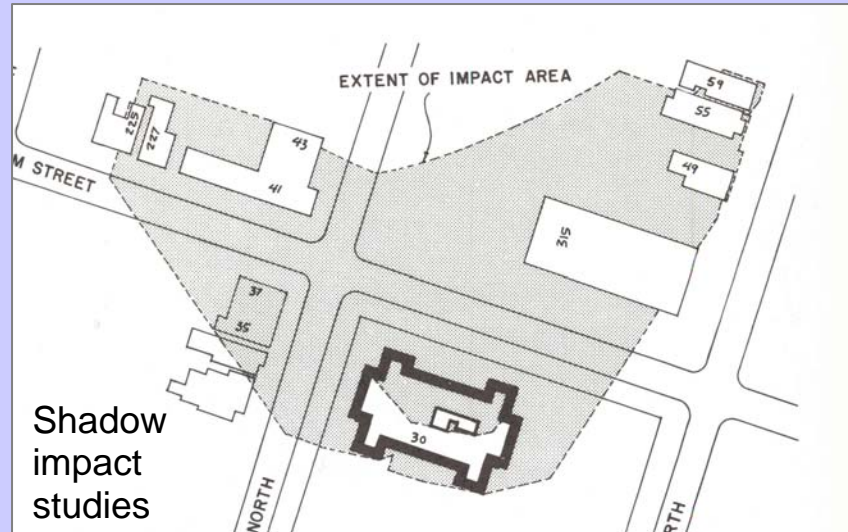
This section of the Title 21 users guide provides thresholds for the minimum amount of sunlight access acceptable for specified uses considered especially sensitive to sunlight shadowing in Alaska’s climate. These thresholds are intended to apply to the review of proposed high rise buildings.

Because Alaska’s low sun angles in the winter make it unreasonable to insist on sunlight access year-round, the sunlight access thresholds below focus on spring, summer and fall. During those seasons the sun’s altitude is higher, allowing for buildings to be located nearer to one another in an urban setting without necessarily having to shade each other all day. Sunlight access becomes particularly important during spring and fall, when the angle of the sun can yield substantial solar radiation to buildings and outdoor spaces, making sunlight access a key factor determining in thermal comfort and usability.

The acceptable extent of sunlight shadowing may vary depending on the affected location or use type. Table 3 below specifies minimum sunlight access considered acceptable for a variety of uses defined in Title 21. These minimum specifications apply to the entire property or developed area of the property being utilized by the use. Exceptions may be granted pursuant to the Title 21 provisions for high rises in AMC 21.07.130C.3.

Table 3: Acceptable Sunlight Shadowing by Type of Affected Use		
Use or Location	Minimum Sunlight Access	Daylight Plane Angle
Residential use or a lot in a Residential district except R-4 or R-4A	Eight hours on Mar / Sept 21.	Maximum of 1 foot of rise for every 2 feet of run
Residential use or a lot in the R-4, R-4A or RO district	Six hours on Sept / Mar 21.	Maximum of 3 feet of rise for every 5 feet of run
Elementary, Middle or High School in the PLI district	9 am to 3 pm (solar time) on Feb / Oct 21.	Maximum of 1 feet of rise for every 2 feet of run
Health Care Facilities in the PLI district	Six hours on Sept / Mar 21.	Maximum of 3 feet of rise for every 5 feet of run
Cemeteries	Six hours on Sept / Mar 21.	n/a
Public Parks		
Community Gardens		
Botanical Gardens		
Commercial Horticulture		

11. Tall Buildings

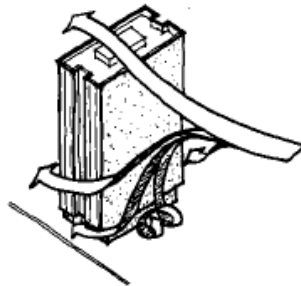


Shadow impact studies

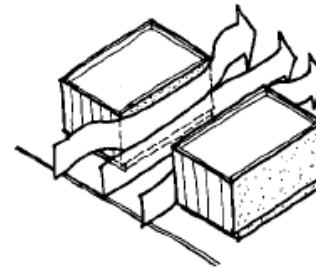


Slender buildings (8-9 story condo)

Wind effects



Downwashing Flow



Channelling Effect

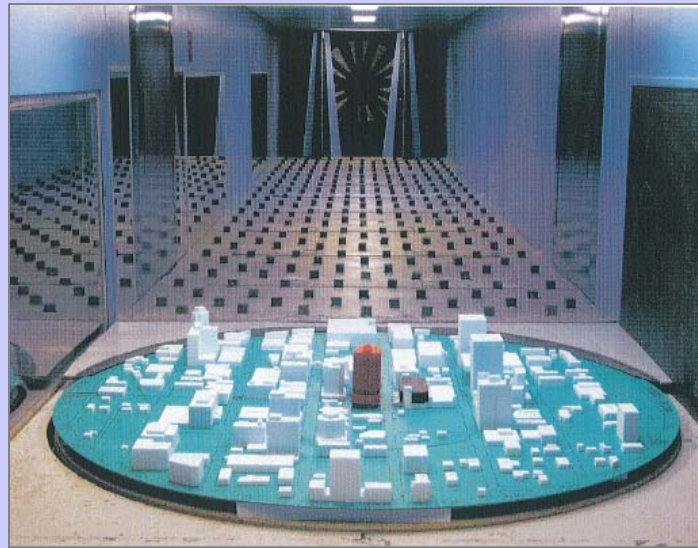
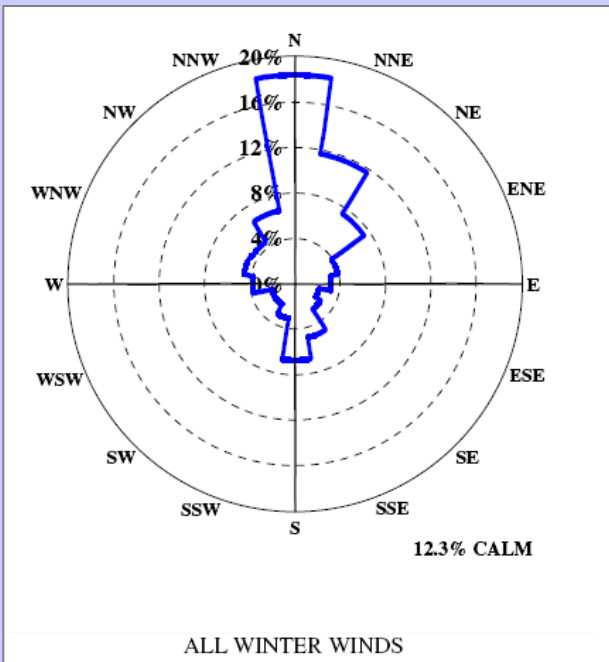
Sloping roofs



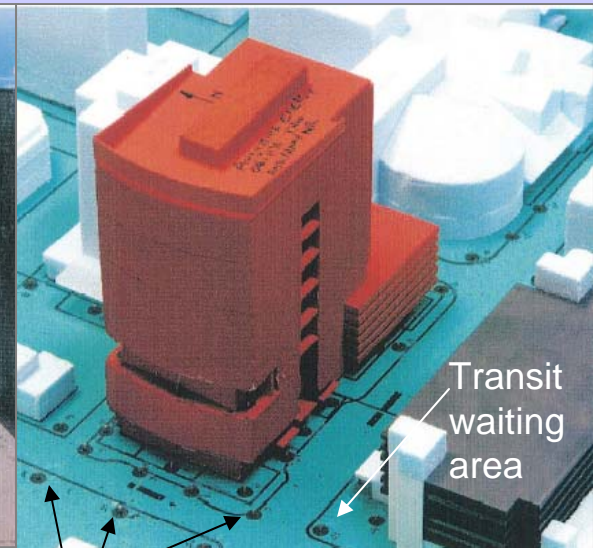
Step backs



12. Wind Studies



Wind tunnel test for Augustine Energy Center (source: RWDI, retained by Neeser Construction)



wind speed sensors (RWDI)

Example Table: Pedestrian Wind Comfort and Safety Categories

COMFORT CATEGORY							SAFETY CATEGORY		
GEM Wind Speed (mph)	Sitting	Standing	Walking	Uncomfortable	Events	RATING			
Category Limit	0 - 6	0 - 9	0 - 12	> 12	Gust Speed \geq 55mph				
	\geq 80%	\geq 80%	\geq 80%	> 20%	> 2 Events Seasonally				
Loc.	Config.	Season	%	%	%	%	RATING	Events	RATING
999	A	Summer	75	85	95	5	Standing	0	PASS
		Winter	50	70	85	15	Walking	1	PASS
	B	Summer	65	80	90	10	Standing	2	PASS
		Winter	45	65	75	25	Uncomfortable	4	FAIL



Sunny and calm spaces