

**ANCHORAGE TITLE 21 REWRITE  
WORKING PAPER ON SOLAR ACCESS ISSUES**

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## I. INTRODUCTION

Solar access, or the preservation of direct sunlight, is a key component in helping a community to prevent the unnecessary shading of streets and buildings. In places like Anchorage with northern climates, the incorporation of solar access provisions into a development code is particularly important due to the reduced sunlight in winter months. In addition, incorporating solar access provisions into a code often has the added benefit of addressing related issues, such as protection from wind and precipitation.

As background for developing solar access provisions for Title 21, we have researched similar provisions in other northern communities, both in North America and elsewhere. Some communities have developed sophisticated programs (solar access permits, etc.) that require a considerable amount of staff effort both to develop and implement.<sup>1</sup> Given the current limited resources for planning and enforcement in Anchorage, we recommend a relatively less staff-intensive approach focusing on two objectives: (1) preserving solar access in both undeveloped areas and existing neighborhoods, and (2) minimizing regulatory barriers to providing for solar access.

Rather than developing a single section called “solar access” in Title 21, meeting both of these objectives will require a number of text edits throughout the code. Below we recommend where solar access-related text might be added throughout Title 21, as well as provide examples of new regulatory language. We look forward to further feedback as to which of these sections should be incorporated into the new Title 21.

As further background, we suggest the community consider the following general questions in reviewing the proposed solar provisions:

### General Topics

- *What types of solar energy systems are most often used?* (e.g., rooftop, south wall, south lot, or detached) [Staff notes: “South wall is most important. Most of the time the sun is at a 45 degrees altitude angle or lower, which makes rooftop systems useful in the summer when solar energy is not needed. In spring, there is enormous enhancement effect off of plain of snow, especially in the spring.”]
- *What areas of the Municipality are most likely to require which level of solar access protection?* [Staff notes: “Low density residential areas; medium density residential and mixed-use pedestrian environments; public buildings, spaces and parks.” Staff also provided the following table.]

<b>Important and sensitive places for sunlight access</b>	<b>Winter (period of sunlight deprivation)</b>	<b>Spring and Fall (swing season between warm and cold)</b>
Interior living spaces of residential dwellings.	Day lighting in winter for health and well-being of residents.	
Civic public use buildings and public schools.	Day lighting in winter for health and productivity.	
Private outdoor spaces such as residential yards and patios, and other usable areas connected to interior		Sunlight exposure for as much of the year as possible to extend the warm season for usable outdoor spaces.

<sup>1</sup> Examples include the development of “hypothetical wall,” bulk plane, and solar access permit provisions, which use various calculations to determine shading requirements. Were the Municipality to examine developing these types of provisions in the future, we recommend “Planning and Zoning for Solar Access: a Guide for Minnesota Communities,” published by the Minnesota Department of Energy and Economic Development, 1983.

Important and sensitive places for sunlight access	Winter (period of sunlight deprivation)	Spring and Fall (swing season between warm and cold)
living spaces.		
Public use spaces such as lobbies, atriums, entrances, transit stops, parks, plazas, and sidewalks.		Sunlight exposure for as much of the year as possible to extend the warm season for usable outdoor spaces, for vitality of city districts.
Gardens and landscaping areas.		Extending the growing season; providing sunlight for enough of the year for plant species. Average last frost date: 5-18. First frost date is when?

### Shading Characteristics

- *In what zoning districts or development situations is shading a problem?* [Staff notes: “(1) Low density residential areas where subdivision design and placement of structures on each lot unnecessarily shade south walls; (2) Residential areas abutting multi-story buildings in higher density or non-residential areas; (3) Downtown (and potentially mixed-use centers) where the goal for density must be balanced with sunlight access to pedestrian spaces; (4) Parks and public spaces that are either poorly located or are threatened by shadowing from neighboring development; (5) multifamily apartments that are shaded, poorly oriented or fenestrated, and have no outdoor access—these are very dark in Anchorage, a major livability issue here.”]
- *Where shading is an issue, how much of the buildings or open areas are shaded?*
- *What is the highest residential density in subdivisions that still assures south wall solar access?* [Staff notes: “There are no residential density maximums in Anchorage, even in the R-6, that can guarantee solar access all year. Because of low sun angles in winter, an insensitively placed home on an R-6 lot can shade its neighbor for part of the year. The only way to protect solar access is to protect it directly, to protect solar access for a specified period of the year, either Feb 21 – Oct 21 or March 21 to Sept 21.”]

### Possible Conflicts with Solar Access

- Tree preservation regulations
- Land to be developed with tall buildings
- High-density residential districts
- High-density mixed-use districts
- Architectural standards that restrict solar technology

## **II. AMENDMENTS TO SUBDIVISION STANDARDS<sup>2</sup>**

The general goals of protecting solar access for yet-to-be-developed areas are to maximize southern exposure, which can be achieved by encouraging street orientation along an east-west axis and allowing for the deliberate spacing of buildings and tree plantings. While the suggested text listed below does not guarantee solar access for all structures, it may facilitate building locations that reduce the likelihood of shadows from becoming a solar access problem.

<sup>2</sup> NOTE: Staff notes: “Staff believes that subdivision standards will not be an effective solution for the majority of Anchorage. The city is platted and Anchorage has few extensive areas remaining for greenfield residential subdivision development. The major northern design issue is to make existing urban areas gradually redevelop as comfortable and livable places. This means solar access standards for buildings and infill projects would be only effective way to assure some degree of solar access throughout most of the city.”

**A. Subdivision Statement of Purpose**

The statement of purpose establishes general objectives of the regulations and reaffirms the Municipality's commitment to solar access protection.

Suggested Text (Placement 21.08.010, Purpose)

The purpose of these standards is to provide maximum solar access both for solar energy purposes and for the general health, safety, and welfare of all residents, understanding that limited sunlight in the winter months is a prime quality of life concern, and that sunlight access to homes, patios and yards can substantially lengthen the warm outdoor season during spring and fall. These standards are intended to ensure that land is divided so that structures can be oriented to maximize solar access, to allow for potential future use of solar energy, to minimize the shading of structures by structures and accessory structures, and, where applicable, to minimize the shading of structures by trees.

**B. East-West Orientation**

Street orientation is one of the most important factors in ensuring solar access. East-west street orientations maximize the amount of building walls with direct southern exposure. The ideal orientation for a solar collector, for instance, is due south. Staff suggests that the acceptable variation in Anchorage is 30 percent.

Suggested Text (Placement 21.08.040, Design Standards)

Streets shall be on an east-west axis (or within a variation of 30 degrees from true east-west) for the purpose of encouraging building and lot orientation most suitable for solar access. If east-west street orientation and alignment of new streets with existing street patterns are not compatible, then east-west orientation shall be considered the more important goal unless existing street and utility patterns are such that east-west orientation is not possible.

The Director may approve an exemption from orientation on an east-west axis (or within a variation of 30 degrees from true east-west) if in allowance for topography (slope and orientation), natural features, existing street and utility patterns, or adjacent land uses.

**C. Subdivision Performance Standards**

Suggested Text #1

Subdivision design shall allow for 75 percent of the homes to have south wall solar access between Feb and Oct 21, for 4 or all 6 hours between 9 am and 3 pm, solar time. These standards may be modified or waived in allowance for topography slope gradient and orientation, natural features, or adjacent land uses.

Suggested Text #2

Each proposed subdivision shall require the greatest possible number of lots with a south orientation. When a proposed subdivision abuts an area developed with or specified for multi-story structures, the location of open space should be designed such that it will buffer shorter structures from the shadows cast by taller structures.

**D. Alternative Lot and Subdivision Design**

*Lot Size Averaging on Curvilinear Streets.* A true east-west street tolerates houses shoulder to shoulder without affecting solar access. Any deviation from the east/west direction, however, requires a widening of the space between buildings. Consideration could be made for allowing size/density averaging for the purposes of maintaining solar access to the south-oriented wall of homes.

*Flexible Lot Configurations and Building Siting Provisions.* Flexible lot configurations and siting provisions might allow subdivision designers to achieve maximum exposure to the sun, regardless of street orientation and the orientation, shape, and size of lots, front setbacks, side setbacks, and back yards.

**E. “Zero” North Lot Line**

This provision means that the yard requirement is substantially reduced, either to zero or a much-reduced number, to allow for the greatest possible yard area between the structure and the south lot line - in effect, maximizing the southern exposure. This provision, as shown in the accompanying illustration, also has the effect of clustering homes toward either the front or rear edges of the lot. The downside to this approach is potential noise and privacy concerns resulting from placing buildings closer to streets, which could be addressed through specific screening requirements.

*Suggested Text (Placement 21.08.040, Lot Dimensions)*

The rear, side, and front yard setbacks may be reduced to zero in order to allow the siting of structures on the northern areas of lots to provide adequate solar access, provided that:

- 1) The lot adjacent to the south yard is held under the same ownership at the time of initial construction and the minimum north yard setback for such adjacent lot is also zero.
- 2) An administrative review application, accompanied by a precise plan, shall be submitted to the decision-making body and approved or conditionally approved prior to issuance of building permits for the dwelling. The plan shall delineate all structures proposed for initial construction. In its review, the Board shall consider the placement of all structures, building material, and finishing of the wall constructed along the north lot line, and possible interference with traffic along major highways fronting the lot or with sight radii at intersections within the development using a north lot line exception.

**F. Building Height Limits**

In order to protect solar access, building height limits should be consistent with actual expected building heights to reduce the number of “tall” structures that would block out more light than their neighbors. We have not provided suggested text here, but would ask the staff to review the height limits of 21.06 to determine if any allowable height limits are substantially greater than most buildings in that district. Eliminating such discrepancies between code standards and actual conditions can help prevent future disputes regarding loss of solar access.

Staff notes: “Staff intends to check the R-1, R-2 and R-3 height limits for homes and duplexes in comparison to actual typical building heights, but has yet to make time to do so. Keep this subsection in the meantime. Reduce the maximum permitted height if the proposed residence will block solar access to buildable area of neighboring lots, and if it would not have much effect on how homes would continue to be built. It would, though, protect solar access from any future shading by unusually tall, but permitted, buildings. Consider reducing the height limit of single-family / two-family in the R-3 to be consistent with R-1 and R-2. There is no imperative for allowing R-3 SF houses to be bulkier.”

**G. Open Space and Easement Dedications**

Subdivision dedications for open space and easements for roads and buildings can either facilitate or restrict solar access, and so the following provisions are recommended.

*Suggested Text (Placement 21.08.050, Dedication)*

Dedications for open space, road, and utility easements shall, whenever feasible, be sited to provide a buffer from shadows, hence facilitating solar access for adjacent structures. Whenever possible, open space and easement dedications shall be located to the south of existing buildings or the site of future buildings. Whenever possible, open space and easement dedications shall be located such that they will buffer shorter structures from shadows cast by taller buildings or likely shadows from areas zoned for tall buildings.

**H. *Shading Plan***

A shading plan may be submitted with subdivision applications in order to demonstrate the impacts of the development on solar access. Shading plans also might be allowed to demonstrate alternatives to the east-west street requirement.

*Suggested Text (Placement 21.08.080(A)(3), Subdivision Agreements, Contents)*

A shading plan of all existing and proposed buildings and trees shall be provided. Tree species shall be indicated and shadow projections shall be based on the expected height of each tree species at maturity.

**III. AMENDMENTS TO OTHER TITLE 21 PROVISIONS**

The following suggested text amendments to various sections of Title 21 are geared toward the protection and promotion of solar access.

**A. *Variances, Minor Modifications, and Other Procedures***

Solar access concerns should be added to the criteria for evaluating variances and minor modifications. Some communities incorporate a detailed report of potential shading impacts along with the notification of affected property owners into variance procedures. More general text might read as follows:

*Suggested Text (Placement 21.03.020 (G), Variances, Approval Criteria)*

The variance does not preclude reasonable solar access on the site by future buildings;

The variance does not diminish any substantial solar access that benefits a habitable structure on an adjacent lot<sup>3</sup>

**B. *Use Designations***

Incorporating solar systems as a permitted or accessory use can help to legitimize and facilitate solar energy use within the community.

*Suggested Text (Placement 21.05.070(C), Table of Allowed Accessory Uses)*

Solar energy systems and any related equipment shall be a permitted accessory use in commercial, industrial, and all other nonresidential districts. Solar energy systems and any related equipment providing energy to one or two structures shall be a permitted accessory use in all residential districts.

**C. *Height***

Height is one of the most important provisions for ensuring adequate solar access. Height regulations often limit solar access generally by creating shadows.

*Suggested Text #1 (Placement 21.06.020, Measurements and Exceptions, Height)*

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<sup>3</sup> NOTE: Perhaps define "substantial" as diminished solar access between February 21 and October 21, between the hours of 9 and 3 pm solar time.

The building height limits for districts shall not apply to cupolas, domes, spires, monuments, roof houses, airway beacons, radio towers, flag poles, towers and other structures for essential services, not to similar structures or necessary mechanical appurtenances extending above the roof to any building and not occupying more than 25 percent of the area of such roof, and not to any component of a solar energy system or sunlight reflector system.

*Suggested Text #2 (Placement 21.06.020, Measurements and Exceptions, Height)*

Structures that are exempt from height restrictions shall be located and designed so as to minimize shading on adjacent properties that could cause solar access problems for residences including residential yards and interior living spaces, for existing solar energy systems or for likely sites of future solar energy systems, or for any of the sensitive public uses: parks, major civic public use buildings and schools.

**D. *Measuring Height***

For purposes of protecting solar access, height standards may need to refer to the peak of the roof and be measured from mean natural grade. Defining it in this way provides the certainty about building height that is necessary for measuring solar access. If the community does not define building height in this way, the REAL BUILDING HEIGHT rather than the prescribed heights in the ordinance must be used in analyzing shading and must be redefined.

**E. *Projections Into Required Setbacks***

In some cases it may be appropriate for solar energy systems to project into required setbacks, provided no visibility is compromised.

*Suggested Text (Placement 21.06.020, Measurements and Exceptions, Setbacks)*

A sunlight reflector (define) or solar energy system may occupy part of the required front, side, or rear setback areas, but may not be sited in a manner that would be in violation of any regulations on visibility at intersections.

**F. *Nonconforming Buildings and Lots***

*Suggested Text (Placement 21.10.030, Nonconforming Structures)*

Solar energy systems or sunlight reflectors that can be installed without any structural alterations shall be allowed on nonconforming structures. Installation of solar energy systems or sunlight reflectors on nonconforming structures that require structural alteration or expansion shall be allowed upon obtaining a variance.

**G. *Vegetation Protection and Solar Access***

Concerns for vegetation protection and solar access may sometimes work at cross-purposes, as trees are often a primary factor in blocking sunlight for both residential areas and open spaces. Factors to consider in tree regulations include: mature height of trees, breadth of the tree canopy (with shorter, stouter trees generally more favorable for solar access than tall ones), and winter shading/twig density. Generally, it is often advantageous to cluster trees on steep and north-facing land not suitable for the development of solar energy systems. However, there is a wide range of approaches to this issue. Some communities choose to regulate the tree species that may be planted, while others focus not on siting, but on trimming those trees that restrict solar access. Staff notes: "In Anchorage, the primary factor is the evergreen tree. Deciduous trees are generally small, except the cottonwood, which is not an accepted landscaping material. Deciduous trees are okay to the south. Siting of evergreens should avoid blocking winter sunlight to south oriented windows or spaces."

Suggested Text (Placement 21.07.020(A), Natural Resource Protection)

Decisions concerning tree species selection, location of plantings, and maintenance practices shall be made in a manner to optimize the availability of solar access for both property owners and adjacent properties.

Adverse effects of evergreen trees on the solar access of surrounding developments shall be minimized to the greatest extent possible when selecting tree species and in locating trees on the south side of buildings and outdoor activity spaces, or along roadways and other public lands. Street tree standards which require a minimum portion of trees be evergreens may be waived when they do not enhance or have a negative effect on solar access.

Solar access availability will be a factor in tree planting requirements. Tree planting requirements may be waived by the Director if necessary to facilitate solar access availability.

**H. Screening Provisions and Solar Access**

Suggested Text (for Placement in fences subsection)

Enclosures provided as a part of a permitted tennis court, ball field, swimming pool, or other recreational facility shall be exempt from the height restrictions of this Section, if the portion of such enclosure above fence height is transparent and will not impact solar access to neighboring properties.

**I. Solar Access Incentives and Standards for Development Projects<sup>4</sup>**

In Anchorage's northern environment the height, location, and shape of a building to a large extent determines the sunlight access and local climate conditions for neighboring buildings and outdoor spaces. One of the prerequisites for northern climate responsive design is assurance of solar access for sensitive land uses and activities, such as residences and public spaces. For example, attention to microclimate is essential to a desirable downtown, town center, or residential neighborhood environment. Because much of Anchorage's future growth will be through infill development projects rather than greenfield subdivision development, incentives or requirements for new buildings to respect solar access to adjacent existing development merit consideration.

**J. Neighborhood Protection Transitions**

A justifiable neighborhood protection concern is the potential of a rezone, commercial project or multifamily structure to overshadow existing residences in adjacent areas, mostly single-family housing. When a non-residential or multi-family district abuts single-family districts with shorter buildings located to the north, solar access in the latter district could be affected. The height of buildings on the northern border of a multi-family district that abuts a single-family district can be restricted to protect solar access. This could involve:

- Incentives that encourage a repositioning of a proposed multi-story structure on the lot, changing its height or mass, or other method, so that the shadow impact area of the proposed building does not encroach into the building envelope of properties in the lower intensity zoning district, or
- A lower allowable height for the higher density district within a buffer strip near adjacent lower intensity districts.

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<sup>4</sup> NOTE: This section drafted by staff.

**K. *Density Incentives for Sensitive Building Heights, Forms and Setbacks***

A multifamily, mixed-use and non-residential building project could receive an FAR bonus if, through repositioning of the structure on the lot, changing its height or mass, or other method, the shadow impact area of the proposed building does not encroach into the building envelope of neighboring properties between March 21 and September 21, between 9 am and 3 pm solar time. This incentive would only apply to cases in which, for a building of the same size or floor area as proposed, the other bulk, density, and setback and standards of this Title could have resulted in overshadowing during this period.

**L. *Solar-Access Based Height Exceptions***

Arbitrary height ceilings are rarely justifiable if the solar envelope of a planned structure will not impact neighboring habitable structures or outdoor spaces. To allow for further redevelopment and full use of land in central city areas, buildings in the RCMU, CCMU and NMU districts could be permitted to exceed the district's building height limits if it can be demonstrated through a shadow impact analysis that the additional building height will (a) not conflict with other purposes and standards of this section or title, and (b) will not further diminish solar access to an adjacent lot, public space or major sidewalk within a certain time period, such as between March 21 and September 21, between 9 am and 3 pm solar time.

**M. *Shadow Impact Analysis***

The discretion to require a shadow impact analysis for proposed tall buildings is common for cities in northern latitudes.

***Suggested Text***

Medium and high profile developments shall be designed so as not to have an unnecessarily substantial shadow impact on neighboring properties and public spaces. The Director and the UDC shall have the authority to require shadow impact studies of medium and high profile development proposals to evaluate the impact of shadows potentially cast by such proposed developments, and to determine appropriate design measures to reduce or mitigate any undesirable shadow conditions. Techniques to reduce the shadow impacts of a building may include, without limitation: repositioning of a structure on the lot, increasing the setbacks, reducing or shifting a building's height or mass, redesigning a building's shape using a narrow east-west profile and angled or terraced roof forms. For the purposes of this subsection, medium, and high profile development proposals include structures greater than six stories in height.

**N. *Reflected Sunlight***

Reflected radiation is an extremely important factor for northern urban climates. The low angles of the winter sun can be used to compensate for a lack of direct solar radiation. In Downtown and other built-up centers, reflected sunlight brightens the environment around buildings. Consideration could be made for encouraging (1) lower heights on the south side of east-west streets, (2) transparent canopies that admit reflected light (illustration needed), and (3) the use of light-colored surfaces to redirect sunlight into adjacent outdoor spaces so as to increase human comfort and amenity of those spaces.

**O. *Sun Traps***

The code could encourage the provision of sun traps as a pedestrian amenity to increase the comfort and amenity of buildings and outdoor spaces during the colder months. An outdoor space can be comfortable for a person with moderately warm clothing at temperatures as low as 40 degrees if the wind is blocked and sufficient solar radiation is available. Promoting direct radiant gain from sun to people, while protecting them

against heat loss from the wind, are the two main ways of improving winter outdoor comfort. Outdoor rooms should be located in the areas with the greatest protection from wind. If possible, the outdoor room should also be placed in an area with good solar access.

**P. *Skylight Penetration***

Maintain existing access to skylight in public open spaces by controlling the height of new buildings on the south side of public open spaces. Promote the design of interior public spaces that take advantage of natural skylight to provide brightness, animation, and orientation.

**Q. *Sunlight Access for Parks and Public Spaces and Sidewalks***

People walking in public spaces and sidewalks are exposed to ambient weather forces. If too cold or too dark for comfort, people move indoors, leaving the public spaces of the city deserted. Building projects along public streets can increase the sum total vitality in public spaces and sidewalks in city centers by modifying the urban microclimate at the street level. In higher-density centers and neighborhoods, every building is responsible, to a great extent, for the creation of public urban space and its microclimate. The microclimate of the spaces between the buildings impacts substantially the life and vitality between the buildings. A single building, by virtue of its shape, height, exposed materials, and treatment at street level may be capable of destroying an urban space and eliminating pedestrian activities. Incentives for solar protection for pedestrian areas could encourage projects to keep a building's external environment—public spaces of the city—within the limits of human comfort.

**R. *Sunlight Access for Public Schools and Community Buildings***

The following text is an example of a minimum solar access protection standard for a particular land use. This same standard could be applied to single-family homes, to mitigate the effects of wintertime light deprivation on the well being of Anchorage residents. Implementation of such standards could be staff intensive.

*Example Text*

Solar access to designated public school buildings, playgrounds and outdoor activity areas shall be protected from shadow impacts by adjacent structures, from February 21 through October 21, between the hours of 9 a.m. and 3 p.m., solar time.

## IV. DEFINITIONS

Definitions of all solar access terms used in the code should be added, which may include terms such as the following:

### **Shadow Impact Analysis**

#### **Shadow Impact Area**

#### **Solar Envelope**

The maximum buildable volume of space available to a building development project that will not shade adjacent sites during specified times and dates, thereby assuring availability of solar access for those sites. The height, volume and shape of the solar envelope varies with the site size and orientation, the times of day solar access is desired for adjacent sites, and the maximum permissible size of the building's shadow impact area on neighboring buildings and properties. Any development within the Solar Envelope will have a predictable impact on adjacent properties. The Solar Envelope (illustrated) is used in a shadow impact analysis to determine the size of the proposed building's shadow impact area at any given time of the year.

#### **Sky View Factor**

The visible portion of the sky. The sky view factor can be reduced by obstructions such as buildings, trees, and landforms. Downtown streets and building facades often have their view of the sky blocked, and ambient light levels reduced in the colder months, by adjacent buildings of the urban canyon.

#### **Solar Access**

The availability of, or access to, unobstructed direct sunlight.

#### **Solar Energy System**

Any device or combination of devices or elements that rely on direct sunlight as an energy source, including but not limited to any substance or device that collects sunlight for use in the heating or cooling of a structure or building, the heating or pumping of water, or the generation of electricity. A solar energy system may be used for purposes in addition to the collection of solar energy. These uses include, but are not limited to, serving as a structural part of the roof of a building or structure and serving as a window or a wall.

#### **Solar Energy**

Radiant energy (direct, diffuse, and reflected) received from the sun.

#### **Solar Time**

Time of day adjusted so that the sun is due south at noon.

#### **South Aperture**

That portion of a wall with a south orientation and covered by windows.

#### **South Orientation**

A south facing orientation of a property line, street frontage, right-of-way, building wall or window, where the line, frontage, wall or window is within 30 degrees of south. Also called "Solar Orientation".