AIR COMBAT COMMAND

Installation Development and Design (ID2)

[Ellsworth Air Force Base, South Dakota]

37th B-1 Bomber Squadron Operations Facility, Ellsworth AFB

ID2

21 June 2010

Table of Contents

ID2

5 DEVELOPMENT AND DESIGN GUIDELINES

6 APPENDICES

[1.1] Document Scope, Applicability and Audience

HQ ACC/A7P

Current guidance removes design process short-circuits by realigning constraints, changing mandates into a performance framework and limiting prescriptive requirements to those critical in meeting Command and Installation functional requirements. Prior editions of design guidance, both at the Command-level and the Installation-level, relied heavily on mandates and prescriptive formula relating to the building form, aesthetics, and materials and this often narrowed design phase investigations into plan arrangement exercises.

Installation-level development and design guidance focuses on identification of regional and local design characteristics, common building methods and preferences, architectural context, landscape standards, infill and building density opportunities, future vision, and establishing installation-centric preferences and strategies. Building aesthetics and character cannot be fully established prior to conducting the concept charrette as aesthetics develop and evolve in response to multiple drivers. Designing and then evaluating aesthetics and architectural character is highly subjective and has to be approached on a project by project basis.

Companion information to this document is provided in the form of an Installation 3D mass model, photographic log database, and the Installation Sustainability Assessment (ISA). The Installation 3D mass model is dimensionally accurate and reflects overall building massing, height, and form. The photographic log database includes all structures on the Installation with the exception of family housing units and utility sheds. The ISA serves to provide current state snapshot of the Installation's 'green posture' and will serve as a way to measure changes over time; indicators should change for the better over time as more green design strategies and processes are put into place.

Applicability

Publication of this document serves to cancel and supersede previous Installation-level design guidance. All external references to Installation-level guidance documents shall now be considered referring to the Installation Development and Design Handbook (ID2). The ID2 serves to inform Future Year Development Plan (FYDP) site selections, Area Development Plan (ADP) designs, Requirements Document (RD) investigations, and Concept Charrette Document (CCD) packages. The ID2 will be summarized in the installation Electronic General Plan (eGP).

Architect-Engineer (A-E) Scope of Work descriptions, Request for Proposal (RFP) solicitations, Design-Bid-Build (D-B-B) and Design-Build (D-B) contracts shall explicitly identify HQ ACC/A7P sustainable development and high performance green building design requirements and objectives as functional requirements.

The ID2 shall be referenced in all Design and/or Construction solicitations to inform Contractors of its existence, and the ensure that the goals underlying the ID2 are incorporated into all new projects. This reference should inform Contractors that the ID2 document does not mandate facility aesthetics, character, or form, but rather that it contains broad design considerations relative to the Installation's built environment. The reference should include a statement that the Contractor's responsiveness to these considerations is an important evaluation factor when reviewing proposals, as well as subsequent design submittals.

Audience

This document provides criteria and considerations used in planning, development, and design of projects that are in addition to technical criteria readily available to professional architects, planners, engineers and interior designers. This document and companion information sources shall be used as primary reference in all planning/siting considerations, building renovation projects, and new construction projects.

[1.2] Development and Design - A Holistic Approach

HQ ACC/A7P

The Command's vision is to lead by example and serve as a role model for sustainable development and high performance green building design in the Air Force, DoD, and the federal government. When "Green Design" is infused into every facet and decision, we'll see both immediate and long range benefits including healthier working environments, reduction of our carbon footprint, and enhancing the enduring quality of facilities while lowering the total cost of facility ownership. To this end, development and design strategies must consider myriad factors and influences, and assure solutions are appropriate to the site, sensitive to the built and natural context, reflective of functional needs, responsive to aesthetic considerations, and embody green building design.

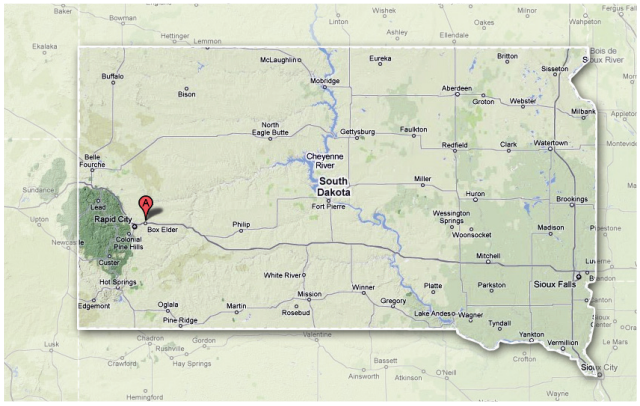
Green design is not optional. Implementing green building design objectives (functional constraints) is required to produce a complete and usable facility or a complete and usable improvement to an existing facility. A green building design approach forms the functional and technical foundation for all performance requirements, development considerations and design constraints made, referenced, or otherwise used in this document.

"Green Design" is synonymous with "Quality Design". Quality design strategies produce results that conserve energy, make efficient use of resources, produce visually appealing structures, reduce environmental degradation, create built environments that are livable, comfortable, safe, enduring, and productive, and shrink the environmental impact of our operations.

Installation

This Installation Development and Design (ID2) guide is intended to provide an overall direction regarding future development and definition of the Base areas and buildings at Ellsworth AFB. Included are principles of design that will give order and functionality to the built environment. Sustainable design principles are foremost in the list of criteria that are being emphasized in this guide, and these principles will strongly influence building functionality and aesthetics.

There is significant amount of undeveloped land within the Base, and the built-up area consists



of fairly homogeneous zones of development. Within the Base as a whole, sufficient land exists to accommodate another entire wing, if needed. A permanent open space corridor was created by removing structures in an area prone to flooding, and this open space effectively separates the flight line and most industrial uses from the administrative, community, and housing areas. Each of these zones has an adequate amount of vacant land to allow for the further development of additional facilities. Future development should occur first on the many vacant infill sites within the built-up area. Infrastructure needed is already in place on these sites, providing a more economical and green solution to future facility siting needs.

There is a heritage of masonry structures here, primarily face brick and concrete masonry. Many innovative project designs have been accomplished using these materials (*see Figure 1.1*). The preference is for designs that are highly-responsive to functional and contextual conditions, which allows building solutions to be uniquely well-suited to their purpose. Designers will find guidance on site development and facility design in this ID2 that will allow flexibility to create one-of-a-kind solutions that are both practical and inspirational, while enhancing a positive relationship with the built environment.

Figure 1.1
Fire/Crash/Rescue Station: Masonry Construction

Figure 1.2
Natural Prarie Environment Requires No Irrigation

Ellsworth AFB is located in the high open plains east of Rapid City, South Dakota. Because of the mountains to the west and the open prairie to the east, a great variance in weather conditions occurs throughout the year, as well as during any given day. The built environment of Ellsworth AFB needs to address these variable weather conditions, providing exterior courtyards and plazas sheltered from the prevailing winter winds, along with areas to appreciate the warming sun during the winter months. By encouraging an increase in development density on Base, a more pedestrian-friendly environment can be created, decreasing the impact of the weather on people walking on Base. Providing shade along walks by planting trees can encourage pedestrian use during the hot, sunny days of summer. Finally, buildings at Ellsworth AFB need to be responsive to sunlight, bringing it into interior environments as natural lighting while mitigating the undesirable effects of glare and heat gain.

Ellsworth AFB has adopted a policy of no irrigation systems for new facilities, except for allowing drip irrigation on new trees. This laudable effort requires that all new plantings on Base, whether trees, shrubs, ground cover, or turfgrass, be able to survive without supplemental irrigation. Use of native and well-adapted plant species is required to make this effort a success (*see Figure 1.2*). The long term benefit to the Base will be lower water usage and improved microclimates in the built-up areas of the Base. Landscape plantings can help create pleasant exterior “rooms”, allowing outdoor activities to take place during more days of the year.

Ellsworth AFB is located in an area with an abundance of natural amenities, from the Badlands to the east to the Black Hills to the west. As such, the area is a magnet for outdoor adventurers, as evidenced by

the exodus from Base each weekend. Unfortunately, this outdoor lifestyle has not been embraced on-Base. Very few people take advantage of the Base's trails and open spaces during the time they spend on Base. Biking and walking paths, along with more destination-oriented amenities, could increase the utilization of the open space located on Base. These types of amenities create a sense of community and encourage healthy and active lifestyles.

Installation Goals

Incorporate sustainable development and green design principles into every facility and site design project at Ellsworth AFB.
Use the Sustainable Design Scorecard and Air Combat Command design guidance to create solutions that meet federal requirements for conserving water and energy, and for sustaining the environment. Innovations that go beyond these requirements are encouraged.

Figure 1.3
37th B1 Bomber Squadron Facility: Daylit Corridor

Make the places where people work and play at Ellsworth AFB functional and pleasant places to be.
Embrace the principles of good architectural and site design to create highly functional and inspirational solutions. Interiors should be full of natural light, and have thoughtful material and color selections. Building layouts should meet the functional requirements as efficiently as possible, and that functionality should be inherent in the building's shape and form. Building layouts should encourage narrow footprints to allow for maximum natural light to penetrate all spaces within (*see Figure 1.3*). Site development around buildings should tie them into their surroundings, allowing the buildings to fully function as part of the Base community.

Make re-use of infill sites a priority in locating new buildings.
Leverage existing roadways, parking areas, and Base utilities by locating new facilities on currently vacant infill sites. Where appropriate, consider removing infrequently-used roadways or relocating short sections of existing roads to create larger infill areas where functionally feasible.

Create a sense of pride in the community at Ellsworth AFB.
Every project should be considered relative to its visual affect on the community at large. Include participation of people who will be affected and seek the opinions of users in all design projects. Seek to have every project be thoughtfully designed to blend with and complement the neighboring facilities.

Foster a quality of life that encourages healthful outdoor activities.
Make outdoor activities a priority. Accommodate bike use with proper trails. Link outdoor activities with pathways to encourage more pedestrian use. Extend indoor activities outdoors by having courtyards and plazas that can accommodate a variety of activities.

[1.3] Development and Design-Requirements and Evaluation Metrics

HQ ACC/A7P Requirements

Command level requirements are described in ACC Instruction, Installation Development and Design Handbook (publication forthcoming). It establishes sustainable development and high performance green building design objectives as primary functional constraints, prescribes HQ ACC/A7P review and oversight processes, identifies architectural and engineering design considerations, and promulgates performance and prescriptive constraints.

Installation Requirements

The Installation Development and Design Handbook (ID2) aligns with Command-level guidance and is intended to be a vital component in developing strategies appropriate to smart growth development and the building site, sensitive to the built context, reflective of building program and scale, responsive to object/background importance, and fully implementing sustainable development and high performance green design objectives. The ID2 describes constraints and identifies objectives necessary to accomplish "Quality Design". Topics and focus areas include: Installation context, architectural context, an Illustrative Plan, overarching development and design guidelines, site selection and development considerations, landscape design issues, architectural design objectives, and technical constraints.

Technical Constraints can be generally categorized either as "Non-Negotiable", such as compatibility with existing fire-alarm communication system or existing keying system, or as "Negotiable", such as a brick blend generally used. "Non-Negotiable" constraints will not directly or indirectly predetermine building aesthetics, character or form, or limit/restrict investigation of high performance green building design strategies.

HQ ACC Development and Design Review Board (D2 Board) Evaluation Metrics

Projects meeting threshold levels established in the ACC Instruction (publication forthcoming) will be evaluated by the HQ ACC Development and Design Review Board (D2 Board). D2 Board evaluations seek to validate conformance with requirements established in Command-level guidance; conformance with requirements established in this document; and adherence to principles of "Quality Design", such as optimizing benefits from site selection, optimizing energy use, protecting and conserving water resources, utilizing environmentally preferable products, enhancing indoor environmental quality, and optimizing operational and maintenance practices. All development and design solutions must embody an "appropriate response" and reflect a responsible use of public funds.

Evaluations of aesthetics and architectural design are inherently subjective and the D2 Board reserves latitude in evaluating design strategies on a project by project basis. Design aesthetics, architectural character and appropriate building form cannot be prescriptively determined in advance of conducting a concept development charrette, as these characteristics arise only after consideration and synthesis of all design drivers. Setting aesthetic preconditions short-circuits design development and will be avoided.

HQ ACC D2 Board Evaluations

D2 Board evaluations may produce recommendations (non-mandatory), directives (mandatory), or a combination of both. In extreme cases, D2 Board directives may include project stoppage in order to address continued or critical failure in meeting functional constraints.

Directives must be implemented unless in very rare and extenuating circumstances a waiver is first endorsed by the D2 Board and then approved by HQ ACC/A7. Waiver requests must be submitted by the BCE Squadron Commander and clearly document the basis for non-compliance and describe actions that will be taken to offset the deviation. Issuance of a waiver does not establish precedent or basis for justifying other projects' non-compliance.

Installation Evaluation Metrics and Evaluations

Installation metrics are those used by the D2 Board with additional interest in evaluating implementation of Installation-centric technical requirements. Installation evaluations may result in recommendations (non-mandatory), directives (mandatory), or a combination of both.

[1.4] Organization of the Document

The Installation Development and Design Handbook (ID2) is organized into five main chapters:

Chapter 1 Introduction
Familiarizes the reader to the need, scope, applicability, requirements and organization of the document.

Chapter 2 Installation Image
Provides insight into the existing conditions found on Base, specifically in areas where new development can be accommodated.

Chapter 3 Development Considerations
Provides information regarding opportunities and constraints found within the development areas.

Chapter 4 Illustrative Plan
Provides a view of potential development opportunities in the next 10 - 20 years.

Chapter 5 Development and Design Guidelines
Highlights approaches to SD&HPGB's, Site Development, and Architectural Design.

Appendices
Identifies specific technical considerations, constraints, and other supporting materials.

[2.1] Installation Image

The mental image that people form of a town or military installation is the information they use to navigate its streets and comprehend its physical layout. This information serves as the basis upon which they develop either a positive or negative impression of its visual appearance. Study of an installation's image refers to an assessment of how legible a place is to residents and visitors. Can a person easily go from place to place based upon their understanding of its street patterns, noticeable landmarks, and other visual cues? Do an adequate number of landmarks exist to help a person organize their mental map? Does the visual character of this place cause a person to like or dislike it?

Answering these questions provides insight into how to make installations better places in which to work, live and recreate. It benefits visitors as well, by making wayfinding easier. It provides insight into how an installation's appearance can be improved by changes to its public spaces (shopping, community services, parks), by adding landmarks, and by improving the visual character of its primary and secondary streets. Every community improvement project - for example a street reconstruction, new building, or park rehabilitation - can contribute to creating a more mentally coherent and attractive community. In most cases, projects undertaken to provide safer roads or construct a new, more efficient facility can also contribute to an improved community image.

This image analysis, along with the other guidance included in this ID2, when aggregated are intended to assist Installation leadership and project designers in improving the visual image of Ellsworth AFB. Examining the design of all new facilities in the larger context of the Base's image will assist designers in creating new buildings which complement existing forms and urban patterns.

Figure 2.2
Ellsworth AFB Main Gate

Installation Image Analysis

Ellsworth AFB has a relatively simple street system that was developed relative to the Base's original runways and a large drainageway which extends north-south up through the Base's center. This drainageway becomes an organizing element for Base land use and its image. The flight line and industrial areas occur west of the drainageway, and most community facilities and housing occur east of the drainageway. This arrangement provides identifiable districts on Base. While most of the Base is located on a gently sloping plain, the drainageway bisects the Base's developed area with a wide stream valley that is lower than the adjoining plain *(see Figure 2.1)*.


Figure 2.1
Landscaped Stream Valley

Liberty Gate serves as the main entry to Ellsworth AFB *(see Figure 2.2)*. From Interstate-90, Liberty Boulevard arcs northwest toward the Base, crossing through presently undeveloped land. Approaching Ellsworth Road, which runs along the eastern edge of the Base, the visitor sees the South Dakota Air and Space Museum on the northeast corner of Ellsworth Road and Liberty Boulevard. The museum's outdoor aircraft and missile displays make the museum a landmark. After entering the Liberty Gate, the road changes name to Davis Drive and extends along the north side of the aforementioned drainageway. A large triangular shaped pond is located just south of the road near where Davis Drive ends, at its intersection with Ellsworth Street. This intersection causes some confusion since westbound traffic comes to a stop before making a right turn to proceed northbound on Ellsworth Street. This is a prominent intersection which should be improved by rebuilding the current intersection to improve traffic flow, and possibly by placing a major landmark, such

Installation Image

Figure 2.3
Rushmore Center: Visual Landmark along Ellsworth Street

as a community facility or a command headquarters on the northeast corner. Traveling north on Ellsworth Street, the visitor encounters a series of administrative, educational and dormitory land uses on the street's east side. Along the west side, a green corridor exists that includes fairly extensive tree plantings north of George Drive. This area is called the Central Park Area and extends north to LeMay Boulevard.

Approaching LeMay Boulevard, one of the Base chapels becomes the focal point on Ellsworth Street, due to the road's alignment. The road swings west of Freedom Chapel, intersecting with LeMay Boulevard. Directional signage occurs at each intersection along Ellsworth Street, for the community and mission-related facilities to the east. Landmarks along this section of Ellsworth Street include the Rushmore Center, religious education center, Airmen's Dormitory complex and Freedom Chapel *(see Figure 2.3)*. Along the west side of Ellsworth Street, the Central Park Area along the drainageway serves as a linear landmark.

To arrive at the Wing Headquarters, the visitor continues north two blocks to Scott Drive, then heads west one block to this complex. The Wing Headquarters and Operations Buildings are landmarks, but are placed in an out-of-the-way location. To find the Base Civil Engineering Administration Building, another landmark structure, one continues west on Scott Drive. The Base Civil Engineering Administration Building is the last major facility before leaving the north edge of the developed area.

Finding one's way to the flight line and industrial area is relatively easy, due to the immense size and visibility of the Pride Hangar, a historic structure located near the center of the flight line *(see Figure 2.4)*. Navigating portions of the streets serving the flight line and industrial area is not as easy. Turning off of Ellsworth Street onto George or Spaatz Drives, and traveling west, results in the driver encountering Twinning Street and Kenney Road. The current low density of buildings in this area makes visibility easy, but wayfinding difficult. The sharp jog at the west end of Spaatz Drive creates some ambiguity as to where the driver is being directed.

Figure 2.4
Pride Hanger: Flight line Visual Landmark

Turning north onto either Kenney or Twinning results in the driver arriving at the east-west portion of Bergstrom Drive. West of Kenney Road, Bergstrom Drive turns to the northwest and disappears among a cluster of industrial buildings and vehicle parking lots. The visitor heading west on Bergstrom Drive follows a winding route that arrives at two squadron operations buildings and the MXG Headquarters. The intersection with LeMay Boulevard is easily missed. Traveling west on LeMay from this intersection takes the visitor to the airfield operations building, fire station and Pride Hangar. The sheer size of the Pride Hangar provides a landmark to which people can be directed to the airfield operations and fire station. However, it would be good to have a landmark or signage at the Bergstrom and LeMay intersection to make the location more memorable.

Visitors entering the south base gate, named the Bismarck Gate, travel north on Ellsworth Street to the Base's developed area. Most commercial traffic headed to the flight line and industrial area turns off at Twinning Street and heads northwest to that area. Visitors headed to the town center district, which includes community services, retail and the Airmen's Dormitories, would stay on Ellsworth Street. The previous discussion regarding the image of Ellsworth Street would apply to these visitors.

Visitors entering the east gate, the Patriot Gate, would travel north on Ellsworth Road from the community of Box Elder, crossing Liberty Boulevard and passing by one of the local elementary schools. Upon entering the Base, these visitors have the town center to their west and family housing areas to their east. Spaatz and Doolittle Drives extend west to the community and dormitory area. Continuing north on Ellsworth Road past Doolittle Drive, the street turns west, just north of the hospital. The road name changes at this point to LeMay Boulevard, which intersects with Ellsworth Street two blocks to the west.

This entry route along Ellsworth Road is easily understood because of the simple land use patterns along its route and the presence of major landmarks, like the sports field complex and hospital. Visitors who continue on the road after it changes from Ellsworth Road to LeMay Boulevard encounter the Exchange/Commissary complex on the road's south side, before arriving at the intersection with Ellsworth Street. This major destination serves as a landmark for most visitors.

The use of a shared name by two parallel streets (Ellsworth Road and Ellsworth Street) might confuse first-time visitors. The historic use of these two street names makes it unlikely that the name of one of them would be changed on the Base to make navigation easier.

There are several recommendations in Section 3.3 CIRCULATION regarding potential street realignments. These suggestions are intended to simplify vehicular movement on Ellsworth AFB. These changes will make it easier for visitors and new residents, who are unfamiliar with the Base, to comprehend its layout. Implementing these roadway improvements will remove some of the points of confusion at key intersections on Base. It may be appropriate to add a landmark such as a static heritage display or civic-scaled sculpture at the intersection of Bergstrom Drive and Ellsworth Street, to help persons headed toward the flight line and industrial area.

Little differentiates the appearance of Ellsworth AFB's important road corridors from its minor roads. Adding select streetscape elements along Ellsworth AFB's important roads would help differentiate them from minor streets and help define various districts that comprise the Base. These streetscape elements would provide visual cues to motorists that they are within, or driving along the edge of a district. The improvements can also help reinforce a sense of community. Streetscape elements might include architectural-design street lights, banners, specialty paving at intersections with pedestrian crossings, and community-scale tree plantings.

In portions of the Base that contain community facilities, a lower, more decorative streetlight should be used along area roads, instead of the standard cobra-style light now used. These streetlights could be designed to allow the addition of banners to either identify the area they occur in, such as "Ellsworth Town Center" or "Wing Headquarters". The banners could also announce community events or celebrations, or highlight the squadrons that comprise the Wing stationed at Ellsworth AFB. In the Base's community area, Doolittle Drive and various streets that serve important community facilities, including the Exchange, Commissary, medical clinic, Combined Club and the Airmen's Dormitories would be candidates for receiving these streetscape improvements. Other area streets where similar streetscape improvements may be appropriate are the streets running in front of the Fitness Center, Wing Headquarters, and near the Bomber Operations and Maintenance Squadron buildings.

The portion of Ellsworth AFB that contains its community facilities and Airmen's Dormitories should be identified as a walkable district on Base. This would encourage more pedestrian activity in this area and improve safety at street crossings. To accomplish this objective, consideration should be given to using colored concrete pavement or pavers at street intersections in this district. The specialty paving would comprise the sidewalk pavement on each corner including the curb ramp approaches. Highlighting the corners will make them stand out, helping to identify this district as a distinct area of the Base.

The traditional use of evenly-spaced street trees as a streetscape element is not appropriate in a semi-arid climate. Trees could however be planted in clusters in intervals along important roads *(see Figure 2.5)*. These tree groups would provide multiple benefits of helping define outdoor space, providing intervals of shade along sidewalks, decreasing glare, and providing the green infrastructure benefits of carbon sequestration, oxygen production, increasing humidity in the immediate area, and reducing stormwater runoff by intercepting precipitation. The location of these tree groups should be designed to complement existing landscape plantings near facilities.

The large tree planting on the west side of Ellsworth Street, across from the Rushmore Center, is an example of how tree plantings along streets can enhance a street corridor and help define the edge of a district, in this case the Central Park Area. Additional tree plantings along the west side of Ellsworth Street, from the Davis Drive intersection north to LeMay Boulevard would better define the edge between the "town center" district and the Central Park Area. Similar tree plantings are needed along the western edge of the Central Park Area, where it is abuts the flightline and industrial district. These would help identify the Central Park Area as an open space amenity, and help visitors and residents recognize that the area is a park, and not vacant or unused land.

Tree clusters along most of the Base's roads would be at a much more modest scale than those along Ellsworth Street. These clusters should be placed to create visual continuity along these streets. They could be designed to take advantage of existing open areas between facilities. They also could be sited to provide screening of undesirable views, or provide buffering where facilities or parking lots are immediately adjacent to the street.

Streetscape improvements would not be appropriate along the flightline and industrial areas. In these districts, having easily identifiable travel routes and well-marked buildings are the best aides to helping visitors navigate these districts.

- *Provide a landmark at the intersection of Davis Drive and Ellsworth Street*
- *Provide a landmark at the intersection of LeMay Boulevard and Bergstrom Drive to demarcate this important intersection*
- *Implement roadway improvements to remove confusion points on Base roadway system*
- *Provide a landmark at the intersection of Ellsworth Street and Bergstrom Drive to direct persons headed to the flight line and industrial areas*
- *Develop streetscape standards to demarcate important streets and district on Base*
- *Develop a streetscape master plan for Base and prioritize streets for implementation*
- *Ensure routes and buildings along the flightline and in industrial areas are well identified with signage*

Figure 2.5
Cluster Plantings of Trees and Vegitation

[3.1] Reuse Opportunities

Reusing existing buildings that are structurally-sound and can be adapted to current needs conserves natural resources, reduces the volume of demolition debris sent to landfills, and decreases the extent of land needed for development on an installation. Using existing buildings for new purposes also reuses the existing infrastructure serving these sites. In-place roadways and utility services can continue to be used to support the new uses.

Reuse of existing parking lots and service drives associated with these buildings provides the additional benefit of avoiding the need to increase the amount of impervious cover. Avoiding additional pavement will prevent additional heat island effects and stormwater generation, and preserve existing greenspace.

Facility reuse is the "greenest" approach to construction of facilities and one that fully accounts for the "real" cost that construction places on the natural environment. Often facility reuse is the most cost effective method of providing new space, if the proposed use can be accommodated in the existing structure. Matching a new use to available building stock may require re-thinking how the space needs are accommodated. Likely it would be different than how space would be laid-out in a new building. Good design can build on these differences to create a new space that incorporates the heritage of the building's past use with the space uses of today.

Ellsworth AFB has a history of reusing existing buildings by re-purposing structures often built for other uses. The most visible example of this is the Pride Hangar, which is now used as a physical training and indoor sports facility *(see Figure 3.1)*. This on-going use helps preserve the building for a future yet-to-be-identified mission-related use. In the Airmen's Dormitories, existing two person rooms have been renovated into single-person suites.

Like many WWII era air bases, Ellsworth AFB has a limited number of older buildings which are suitable for reuse. In recent years, the Base has aggressively removed older temporary construction buildings and functionally obsolete buildings, due to the high cost of renovating and operating them. While this strategy reduces the number of buildings on Base for potential reuse, it will provide long-term benefits relative to operations and maintenance costs. This strategy also creates a number of infill sites immediately available for a new use.

Current Reuse Projects

Security Services (Building 4400) – This large single-story building exceeds the amount of space typically provided for security unit operations. Consideration is being given to relocating security services to a new facility and converting the current building to a community center, so it would complement other

Figure 3.1
Pride Hangar: Repurposed as Fitness Center

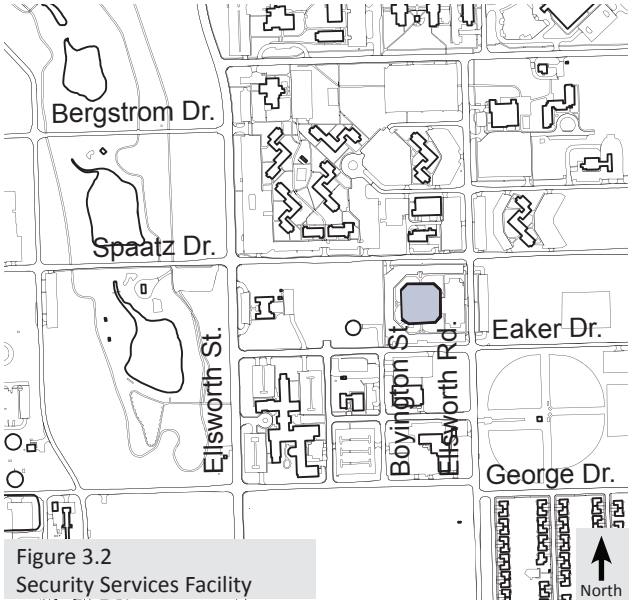


Figure 3.2
Security Services Facility

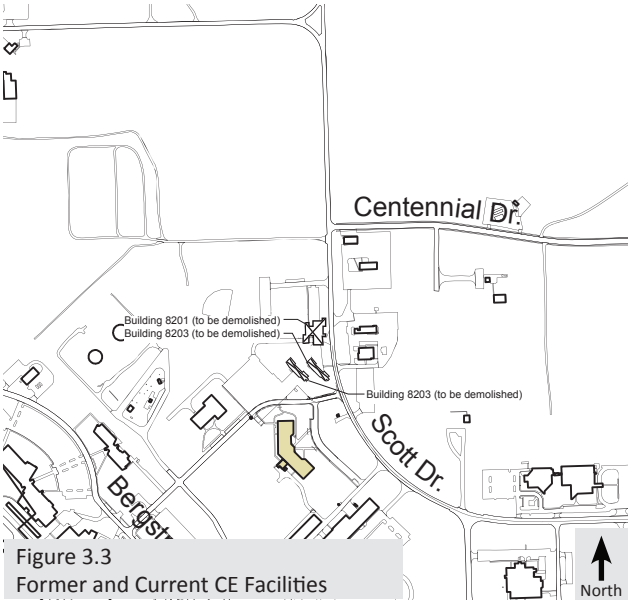


Figure 3.3
Former and Current CE Facilities

community uses along the proposed north-south pedestrian spine walkway. Moving forward with this proposal would require that funding be obtained for a new security services facility *(see Figure 3.2)*.

Base Civil Engineering Commander's Office (Building 8116) – The new Base Civil Engineering Administration Building has been completed and three former Base Civil Engineering buildings have been demolished (8201, 8202, and 8203). The current Base Civil Engineering Commander's Office building will be reused by the Office of Special Investigations *(see Figure 3.3)*.

Buildings Not Considered for Reuse

Not every building is a candidate for reuse. Building condition, size, configuration, and location may make reuse impractical or at odds with installation-wide planning goals. Examples of this situation exist at Ellsworth AFB. With the completion of the new Base Civil Engineering Administration Building, several older structures have been demolished to make room for a future maintenance training facility on the same location. These include Buildings 8201, 8202 and 8203. *(see Figure 3.3)*.

[3.2] Infill Opportunities

Several newer buildings completed at Ellsworth AFB demonstrate an understanding of the value of infill projects. On the flight line, the new Base Operations building (7501) and Fire Station (7502) were sited on infill locations. Similarly, the new Base Civil Engineering Administration Building (2125) is located in the industrial area on an infill site.

Proposed Mission-Related Infill Projects

The following mission-related infill projects were identified as part of the Infill Design Charrette conducted with Base Civil Engineering staff.

AGE Shop

A new AGE Shop is proposed along the flight line, near the location of former building 7503 *(see Figure 3.4)*. This new facility will relocate equipment stored at several locations to a single shop where it can be maintained. With the realignment of Tinker Street and McConnell Boulevard, as outlined in Section 3.3 CIRCULATION, space would exist adjacent to the AGE Shop for a future AGE headquarters building.

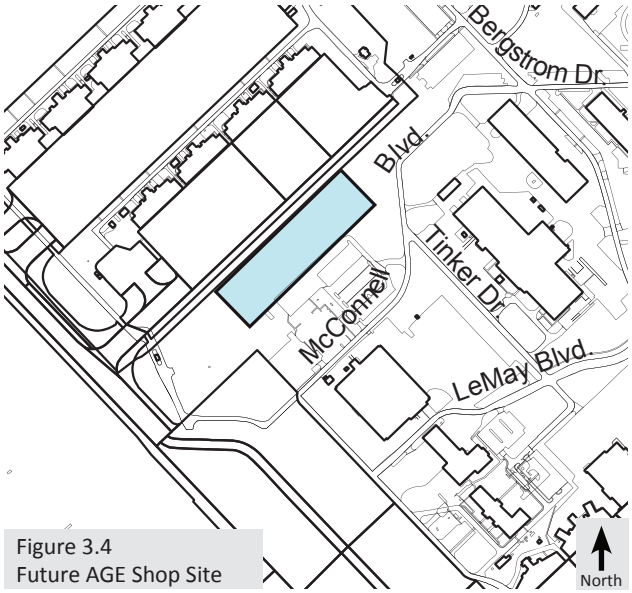


Figure 3.4
Future AGE Shop Site

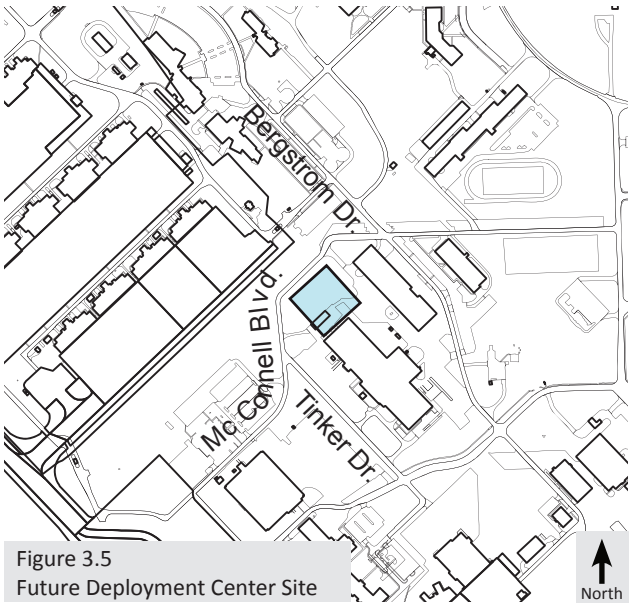


Figure 3.5
Future Deployment Center Site

Deployment Center

An addition to the north end of the Base Supply Building (7510) will serve as the new Deployment Center *(see Figure 3.5)*. This new building will be constructed on space currently used for parking.

Vehicle Maintenance Parking Expansion

This parking lot expansion is not a discrete project, but rather a benefit that would occur as a result of realigning Bergstrom Drive and Kenney Road through this area *(see Figure 3.6)*. The road realignment is explained in Section 3.3 CIRCULATION.

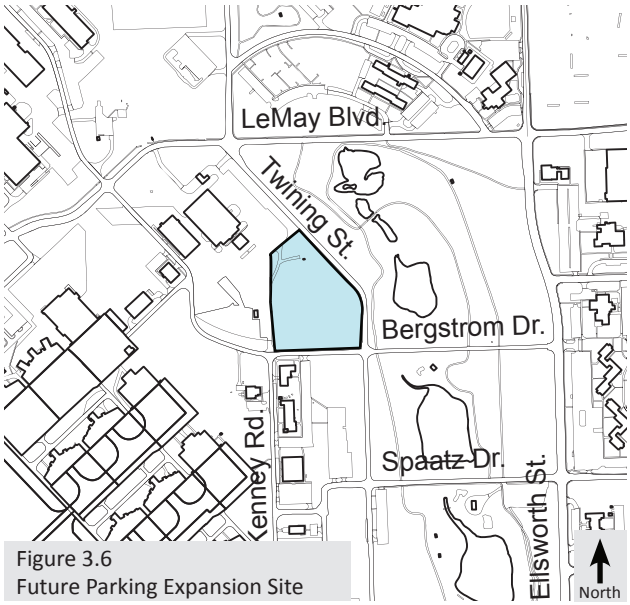


Figure 3.6
Future Parking Expansion Site

Infill Opportunities

LOLA Expansion

Several phases remain to be constructed as part of the Live Ordnance Loading Area (LOLA) expansion *(see Figure 3.7)*. One key feature which is missing from current plans is for the extension of fueling facilities to the LOLA pad. Adding this feature is critical to creating a fully functional facility.

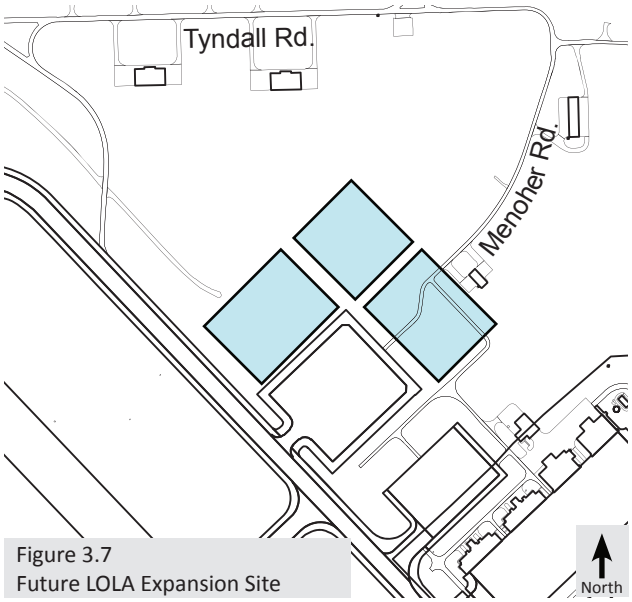


Figure 3.7
Future LOLA Expansion Site

Munitions Operations and Headquarters Complex

A new Munitions Operations complex with a headquarters building is planned for the area immediately south of Menoher Drive, across from the entry to the ordnance storage area *(see Figure 3.8)*. These buildings would relocate these functions to a site between the storage area and the flight line. It is proposed that Quesada Drive be extended south to Bergstrom Drive, to minimize travel distances between the new facility and the flight line.

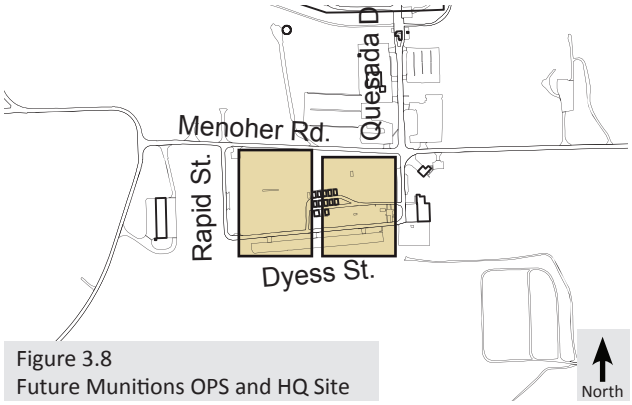


Figure 3.8
Future Munitions OPS and HQ Site

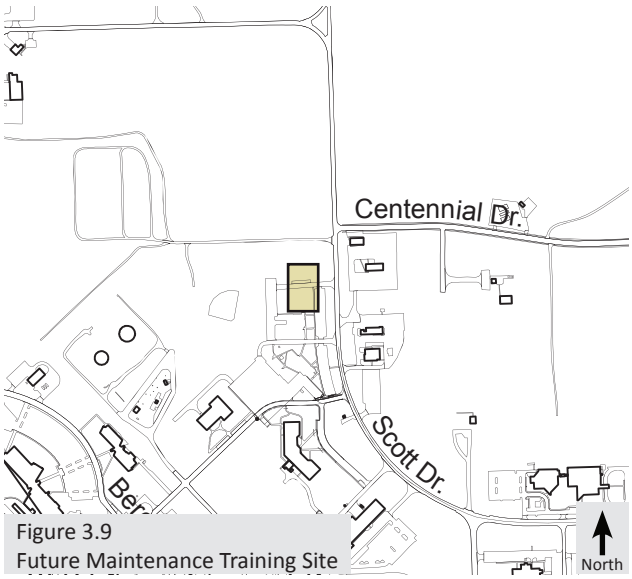


Figure 3.9
Future Maintenance Training Site

Maintenance Training Building

The new Maintenance Training facility will be built on the site of the former Base Civil Engineering administration offices (Buildings 8201, 8202 and 8203) *(see Figure 3.9)*. It will share parking with the new Base Civil Engineering Administration Building.

Veterinary Clinic

A new Veterinary Clinic is proposed on Centennial Drive near the existing Military Working Dog facilities *(see Figure 3.10)*. This new clinic will replace the existing clinic (Building 6010) at the intersection of Doolittle Drive and Schriever Street. The existing clinic will most likely be demolished to provide additional parking for the DFAS complex to the west.

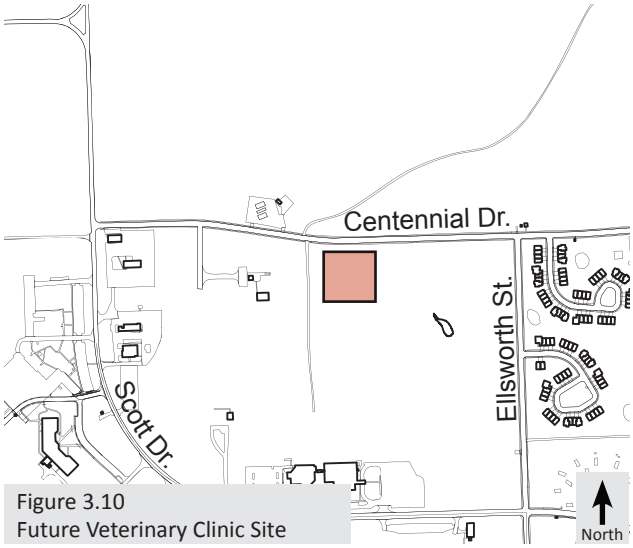


Figure 3.10
Future Veterinary Clinic Site

Communications Building Replacement

Building 4307 is programmed to be replaced by a new Communications building, to be constructed adjacent to 4307 *(see Figure 3.11)*. Portions of the existing building containing communications equipment will be incorporated into the new building, to avoid the cost of relocating the communications equipment to a new location. Building 4307 is located on the north side of Spaatz Drive, adjacent to a proposed north-south pedestrian walkway. This land for a Communications facility along the pedestrian spine detracts from the atmosphere of a town center. Base Civil Engineering is investigating the possibility of leaving the communications equipment in place and moving the other communications function to a more appropriate site in an industrial or administrative area of the Base. This would free up the remainder of this site for a community land use.

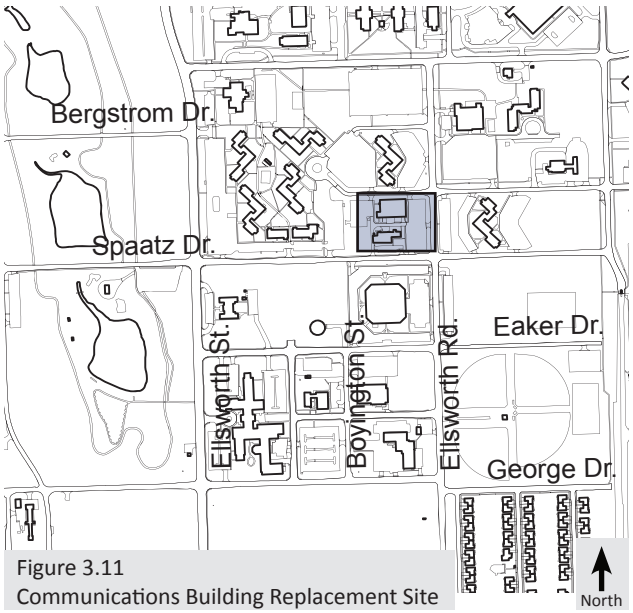


Figure 3.11
Communications Building Replacement Site

Proposed Community-Related Infill Projects

The following community-related infill projects were identified as part of the Infill Design Charrette conducted with Base Civil Engineering staff.

Religious Education Center

This addition to the north Chapel (2009) would relocate Religious Education from Building 2405 to a new classroom space constructed on the north side of the existing Chapel *(see Figure 3.12)*. No additional parking would be required because the chapel shares parking with the adjacent DFAS office building.

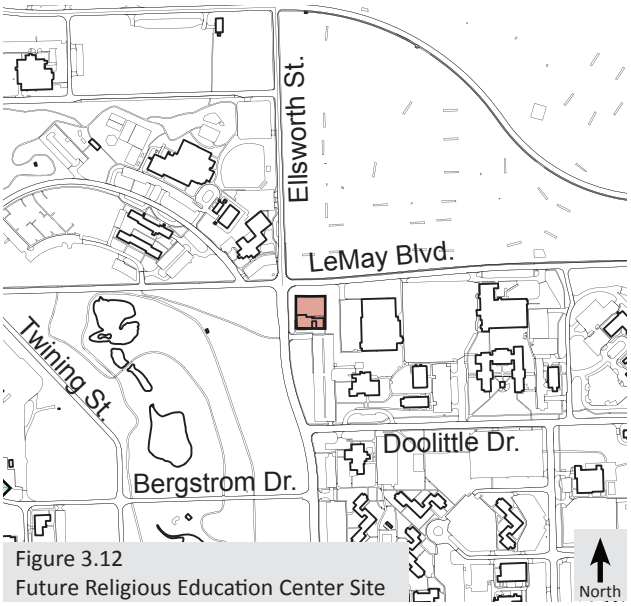


Figure 3.12
Future Religious Education Center Site

Professional Military Training Center

A new Training Center is needed to replace the current Airmen's Leadership Training Center on the west side of the runway, in Building 7430. The current facility was constructed to serve as a ready facility for bomber pilots, and is obsolete. The new facility would be located on the site of Building 2405 near the Rushmore Center, currently used for Religious Training *(see Figure 3.13)*. The new Training Center should be designed to relate to the north-south pedestrian spine.

Figure 3.13
Future Professional Military Training Center Site

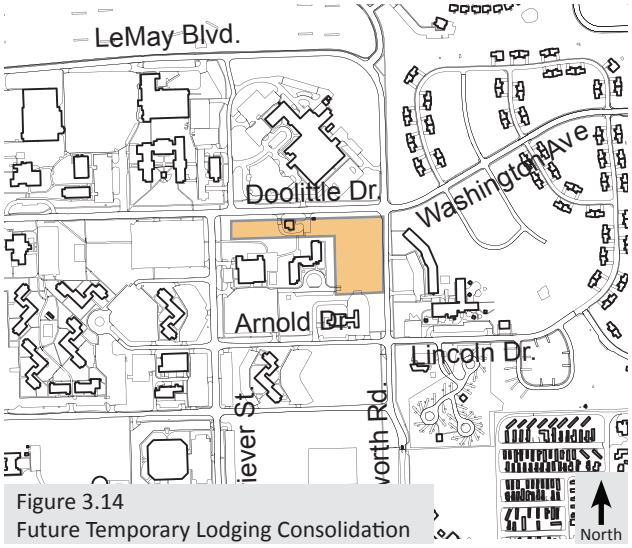


Figure 3.14
Future Temporary Lodging Consolidation

Temporary Lodging Consolidation

A vision exists to locate all Temporary Lodging facilities in a single area of the Base *(see Figure 3.14)*. The location selected near the existing Cedar Inn (Building 5907) would place temporary lodging adjacent to the Combined Club and Shopette and within easy walking distance of the Exchange, Commissary, Library, and Movie Theater.

Youth Soccer Field

A new youth soccer field will be constructed north of the existing ballfields adjoining Ellsworth Road, after the new Patriot Gate is completed *(see Figure 3.15)*. This new field will replace one eliminated during the gate's construction.

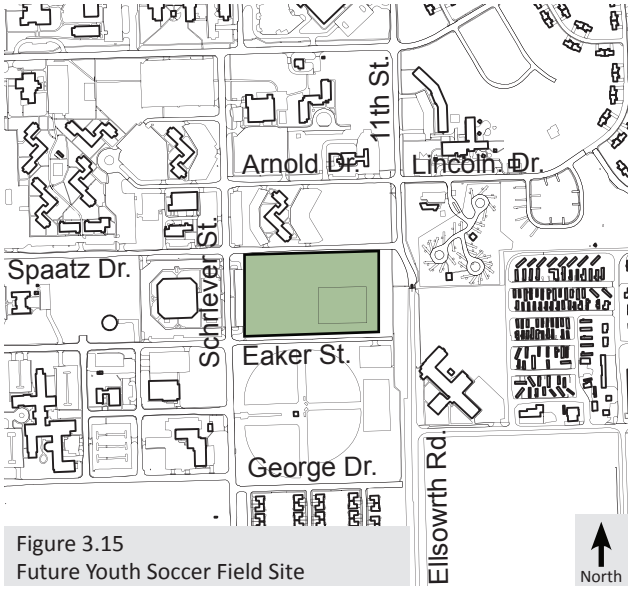


Figure 3.15
Future Youth Soccer Field Site

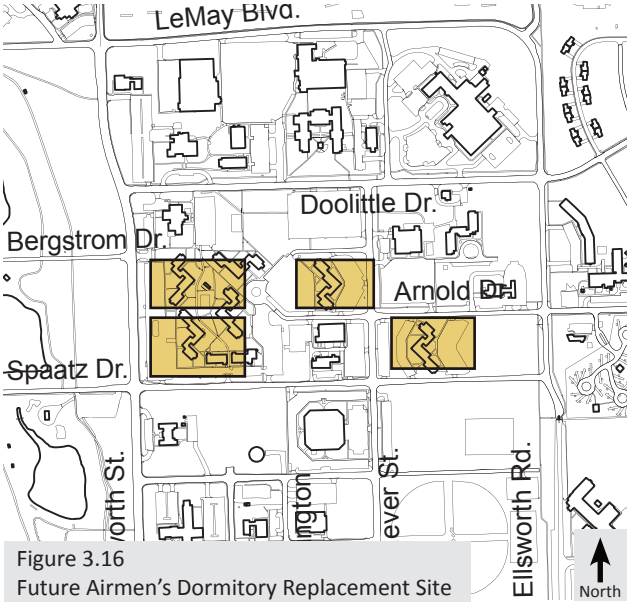


Figure 3.16
Future Airmen's Dormitory Replacement Site

Airmen's Dormitory Replacement

Replacement of the Airmen's Dormitories at Ellsworth AFB will occur in the distant future because the existing dormitories have been remodeled to serve current needs *(see Figure 3.16)*. It appears feasible to construct new dormitories on unneeded portions of existing parking lots to replace the dormitories in the same general location. The current dormitories would then be demolished to provide open space. The new dormitories would be oriented to reinforce the proposed pedestrian spine walkway and add vitality to the town center.

Figure 3.17
Proposed Pedestrian Spine Walkways/Infill Sites

Figure 3.18
Future Town Center Pedestrian Walkway Corridor

Pedestrian Spine Walkways

These two north-south and east-west walkways would connect facilities in the portion of the Base that serves as its "town center" *(see Figure 3.17)*. The intent and extent of these walkways is explained in Section 3.3 CIRCULATION. A number of planned infill projects will occur adjacent to the Pedestrian Spine Walkways. All of these projects should be designed to facilitate the walkways' development *(see Figure 3.18)*.

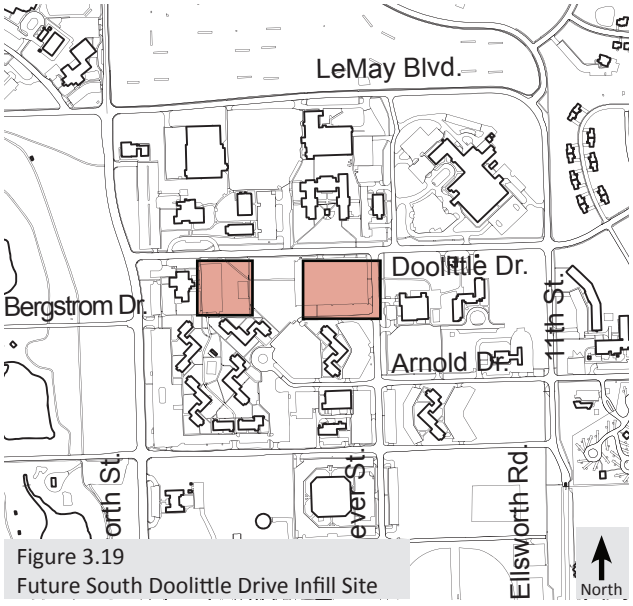


Figure 3.19
Future South Doolittle Drive Infill Site

South Doolittle Drive Infill Sites

Two potential infill sites are located on the south side of Doolittle, between Ellsworth and Schriever Streets *(see Figure 3.19)*. These sites were identified as potential infill sites during the Infill Design Charrette conducted with Base Civil Engineering staff. No specific future uses were identified for these sites during the Charrette. It was discussed that an administrative or community facility use would be the most appropriate since the sites occur in the town center district. The proposed pedestrian spine walkway would run between the two sites, separating them. The west site is currently open space with an outdoor basketball court, and is approximately 110,000 square feet. The east site is currently used for parking for the adjacent Air Force Finance facility. If used as a building site, the parking lot would need to be relocated elsewhere. The east site is approximately 150,000 square feet.

Flight Line and South Industrial Infill Sites

The following infill sites were identified along the flight line as part of the Infill Design Charrette conducted with Base Civil Engineering staff. These sites occur along the east edge of the South Dock area. Generally, the South Dock area is under-utilized, due to the age and size of most of the hangars in the area. At some point in the future, the majority of these hangars could be demolished to allow bed-down of a new flight-related mission. Currently most of these hangars are used for storage.

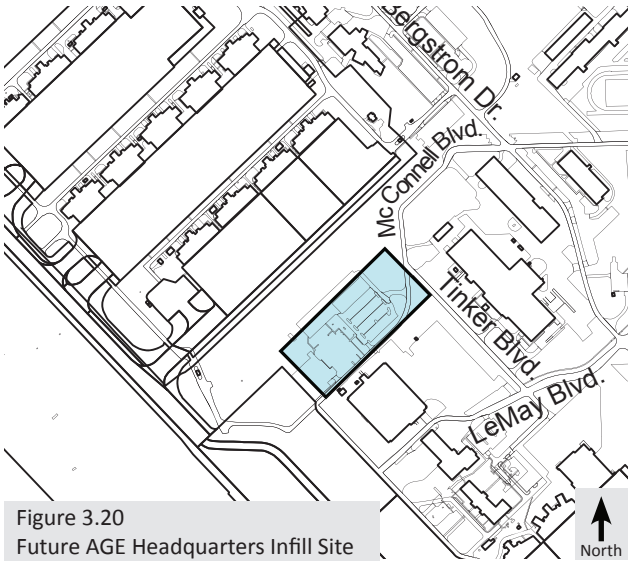


Figure 3.20
Future AGE Headquarters Infill Site

Potential AGE Headquarters Building

By realigning short segments of Tinker Street and McConnell Boulevard, as outlined in Section 3.3 CIRCULATION, an additional building site could be created adjacent to the proposed site for the new AGE Shop *(see Figure 3.20)*. A logical use for this infill site would be for a future AGE headquarters building.

PRIDE Hangar Site

Retaining and reusing this historic structure is a method of preserving its location for another future flightline use. This use could retain and renovate the existing hangar or replace it with a new structure *(see Figure 3.21)*.

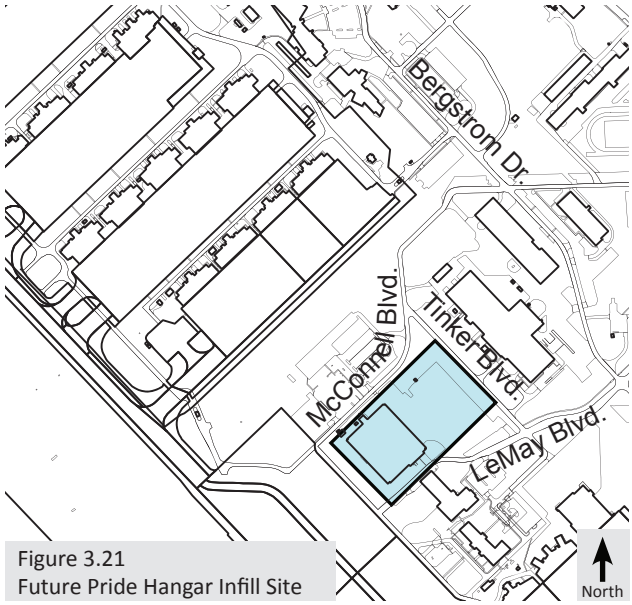


Figure 3.21
Future Pride Hangar Infill Site

Potential Squad Ops Buildings

Two sites exist on the north and south sides of Travis Drive that could be used for future Squadron Operations buildings associated with the hangars to the west (Buildings 7610 to 7622) *(see Figure 3.22)*. Relocation of the salt storage building (Building 7635) may be required to redevelop the site north of Travis Drive, but the existing flight line maintenance functions in Building 106 could remain. Redevelopment of the site south of Travis Drive would occur after the realignment of the Kenney Road and Bergstrom Drive intersection.

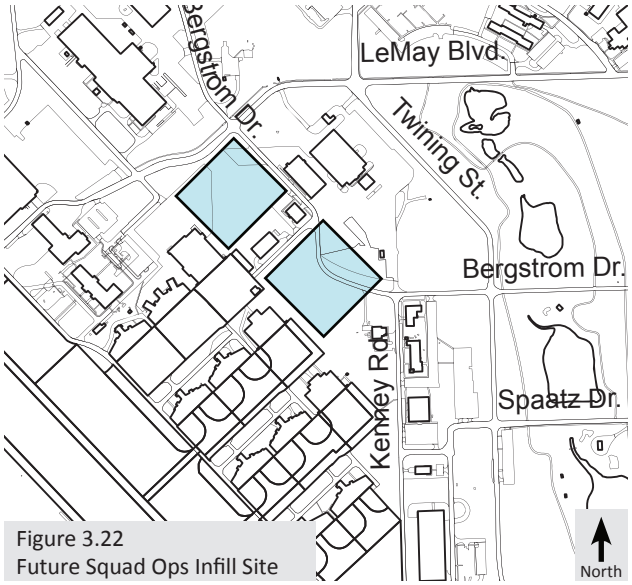


Figure 3.22
Future Squad Ops Infill Site

South Industrial Area

A large industrial redevelopment site could be created by utilizing vacant land that extends south of Bergstrom Drive, between Kenney Road and Twinning Street to the north edge of the existing fuels area by Building 819 *(see Figure 3.23)*. Buildings 1011, 1008, 1015, and the portion of Building 1007 containing communications equipment would remain, as would the two ground water storage tanks (920 and 922). The area east of these buildings and the vacant areas to the south could be redeveloped.

Large Infill Sites

Several large infill sites have been identified in the Ellsworth AFB General Plan and are being held to serve yet unidentified future needs. The infill sites have not been assigned a priority for use as Infill

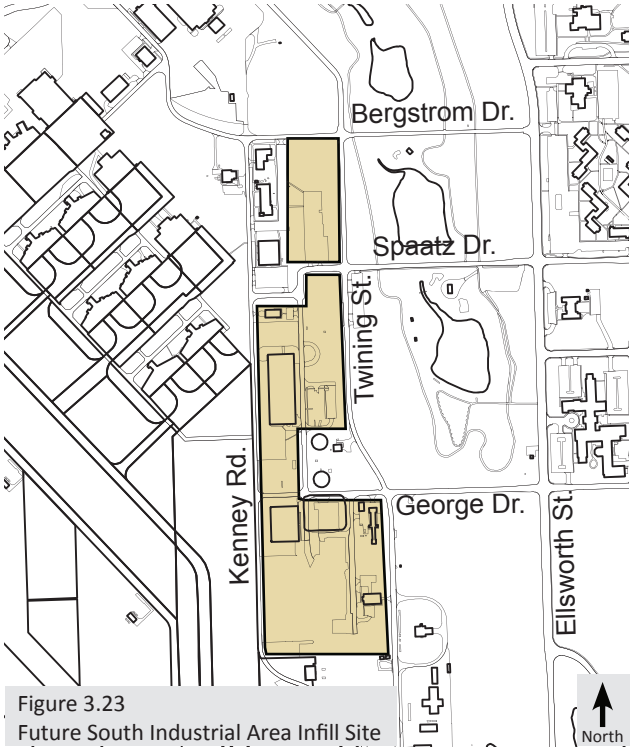


Figure 3.23
Future South Industrial Area Infill Site

Areas because specific uses for them have not been identified. If Ellsworth AFB continues to locate new buildings on available infill sites, these large infill areas can be reserved for future uses that require large amounts of land. These uses would most likely be related to the bed down of new missions or significant expansion of existing missions at Ellsworth AFB.

Generally, Infill Areas #1, #2, and #3, due to their location at the north end of the flight line and industrial areas, would be best suited to those types of uses. Infill site #4, due to its large size and prominent location just inside of the Liberty Gate, makes it appropriate for a major administrative or community use. The site's location has the potential to serve as a southern terminus for the Base's town center. Infill Site #5 is remote from other Base facilities, being located west of the runway. This site would be best suited for a use that is self-contained or requires a minimum of traffic between it and other Base functions, and does not need to take into effect the runway noise as the other infill sites would. To utilize this site, a new west gate would likely need to be developed. By holding these Infill Areas in reserve, the Base can insure that it can accommodate new or expanded missions which will help sustain the Base.

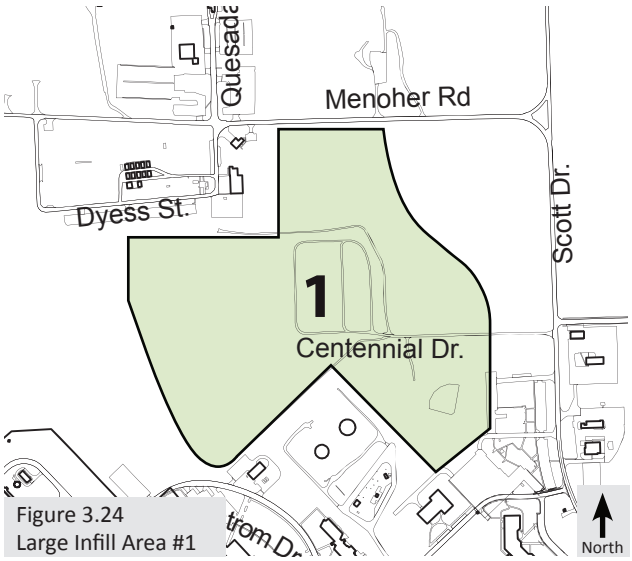


Figure 3.24
Large Infill Area #1

Infill Area #1

This 58 acre site is located northwest of the Base Civil Engineering complex. It includes the current RV storage yard and vacant land. A floodplain area that is west of Scott Drive defines its eastern edge, Menoher Drive runs along it northern edge, and its western edge is defined by another floodplain. The POL storage facility acts as its southern boundary. The Base ordnance storage area is northwest of Infill Area #1. A new munitions operations and headquarters complex is planned on the area known as "Camp Lancer", on the northwest corner of Infill Area #1. Potential infill uses for this site would be support activities related to the flightline or nearby ordnance storage area *(see Figure 3.24)*.

Infill Area #2

Most of this 31 acre site is located northeast of the intersection of Scott and Centennial Drives. This area abuts both roads except near their intersection, where a floodplain occurs. Ellsworth Road currently extends to the southeast corner of the site where it intersects Centennial Drive. A small part of this infill site, approximately 4 acres, is located west of Scott Drive. The northern edge of this parcel abuts Menoher Road, providing good access to this parcel *(see Figure 3.25)*.

This infill site consists of currently vacant land. A possible use for the larger parcel might include having it serve as a site for a new large mission that requires a campus with new buildings. The smaller parcel west of Scott Drive could be developed as part of the campus or used for a separate, smaller use.

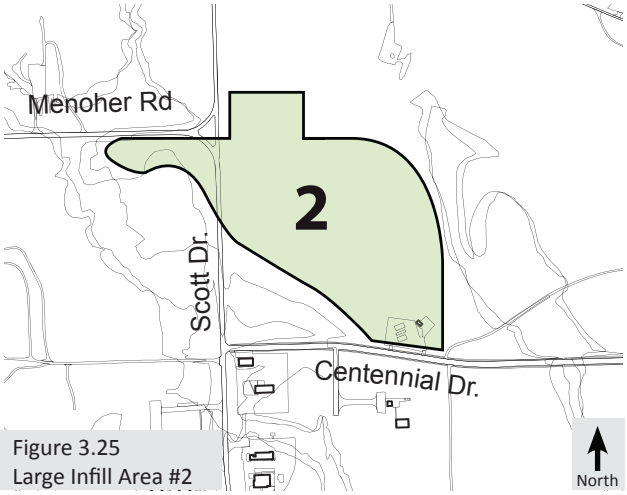


Figure 3.25
Large Infill Area #2

Infill Area #3

This 48 acre infill area surrounds the Wing Headquarters complex on three sides. About one-third of the site, approximately 11.5 acres, is south of the headquarters complex on mostly vacant land that occurs between Mitchell Street, Westover Avenue, Ellsworth Street and Scott Drive. The larger portion of the infill area is north of the headquarters, extending from Scott Drive to Centennial Drive. The military working dogs complex and future Veterinary Clinic are located at the site's northwestern corner. Two floodplains form the area's east and west edges *(see Figure 3.26)*.

The most appropriate use for this infill area would be an administrative use that would complement the Wing Headquarters. The southern portion of the site could be used for sportsfields for the adjacent Fitness Center until it is needed as an infill site.

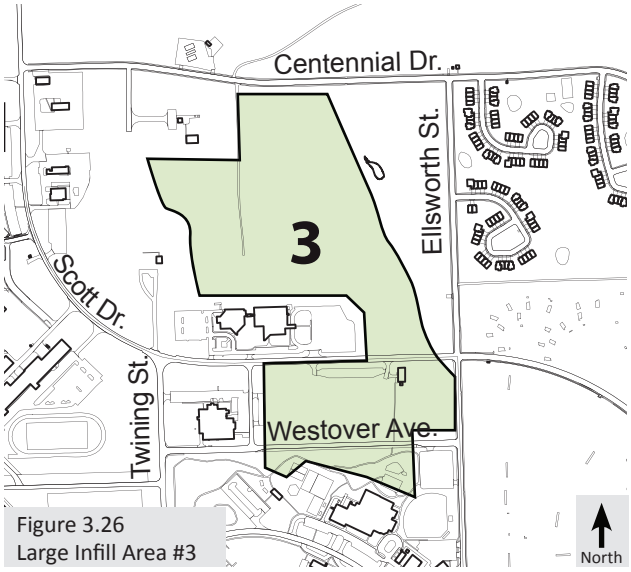


Figure 3.26
Large Infill Area #3

Figure 3.27
Large Infill Area #4

Infill Area #4

This infill site has the highest visibility of the five identified large infill sites. The 50 acre site sits just north of the main gate, on Liberty Boulevard. Ellsworth Street runs along the western edge of this site. George Drive forms its northern boundary and Schriever Street serves as its eastern edge. Family housing occurs along the area's eastern edge, administrative and community facilities occur along its northern edge, and permanent open space exists along its western and southern boundaries. The area has a fairly significant slope, generally from east to west. The northeast corner of the site was once used for an AAFES gas station *(see Figure 3.27)*.

The prominent location of this infill area mandates that its future use be carefully considered. The use must be appropriate to the highly visible site and must allow for the design of a building or series of buildings that can creatively take advantage of the sloping landform. Any development on this site should be designed to provide occupants with views of the adjacent lake, open space, and the Base golf course.

The infill area's prominent location makes it a prime site for an administrative or community use that would benefit by its proximity to the Main Gate.

Infill Area #5

This infill site is located on the west side of the runway in the Base's southwestern corner. This 160 acre site

consists of vacant land which fronts the portions of two off-base roads, West Gate and Country Road. This site would, in theory, accommodate the mission needs of a second wing at Ellsworth AFB. This site would be best suited for a use that is self-contained or requires a minimum of traffic between it and other Base functions. Due to its proximity to the runway, any future uses would need to be compatible with runway noise *(see Figure 3.28)*.

A major challenge in developing this infill area is providing a safe and convenient vehicular connection to the remainder of the Base. Kenney Road is the only surface connection between Infill Area #5 and the remainder of the Base. This road crosses the airfield just south of the runway's southern end, creating operational and security issues. A different alignment for a connector road would be required to develop this area. To effectively utilize this site, a new west gate would likely need to be developed.

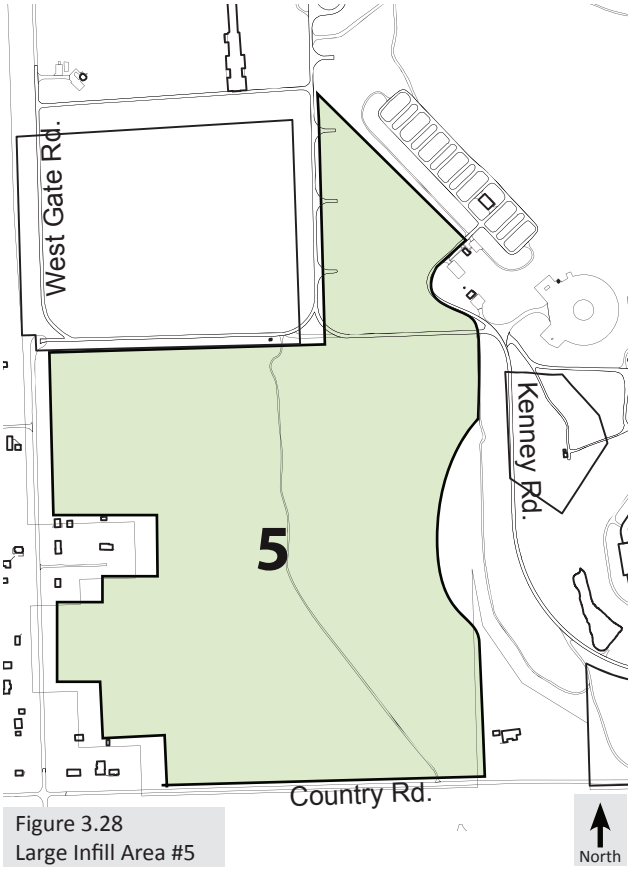


Figure 3.28
Large Infill Area #5

[3.3] Circulation

Vehicular Circulation

The major transportation routes at Ellsworth AFB form a fairly simple and logical layout. The Base's major transportation routes run north-south, extending from the three Base gates along its southern boundary. A series of major and minor east-west streets provide cross-connections. The only major road which doesn't conform to the grid pattern is the western half of Bergstrom Drive which bends to the northwest, following the eastern edge of the flight line.

The Base's original runways ran north-south and east-west, essentially acting as an extension of the Base's grid street system. Later these runways were replaced with the current runway which runs northwest to southeast. Flight line facilities were developed along the east apron of the runway and existing roads were altered to serve these new flight line structures. Bergstrom Drive, which originally was one of the Base's east-west streets, was extended northwest along the new flight line. Several secondary and minor roads extend southwest from Bergstrom to serve specific buildings along the flight line.

Traffic patterns appear to function well on most of the Base because the road system allows for traffic volumes to be spread over a number of streets. Two areas warrant consideration for street realignment, in order to improve traffic flow. The first is at the intersection of Davis Drive and Ellsworth Street. Currently, Ellsworth Street provides through-movement for traffic. If the Liberty Gate on Davis Drive is to serve as the main base gate, it would be logical to rebuild the intersection so the through-movement is a sweeping curve that transitions traffic moving along Davis Drive onto Ellsworth Street. The southern extension of Ellsworth Street would intersect the new curve at its midpoint, creating a "T" intersection. Northbound traffic on Ellsworth Street would be controlled by a stop sign at the new intersection *(see Figure 3.29)*.

Figure 3.29
Realignment of Ellsworth Street and Liberty Boulevard

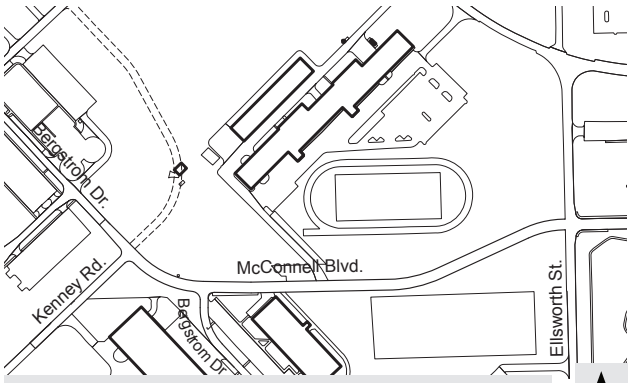
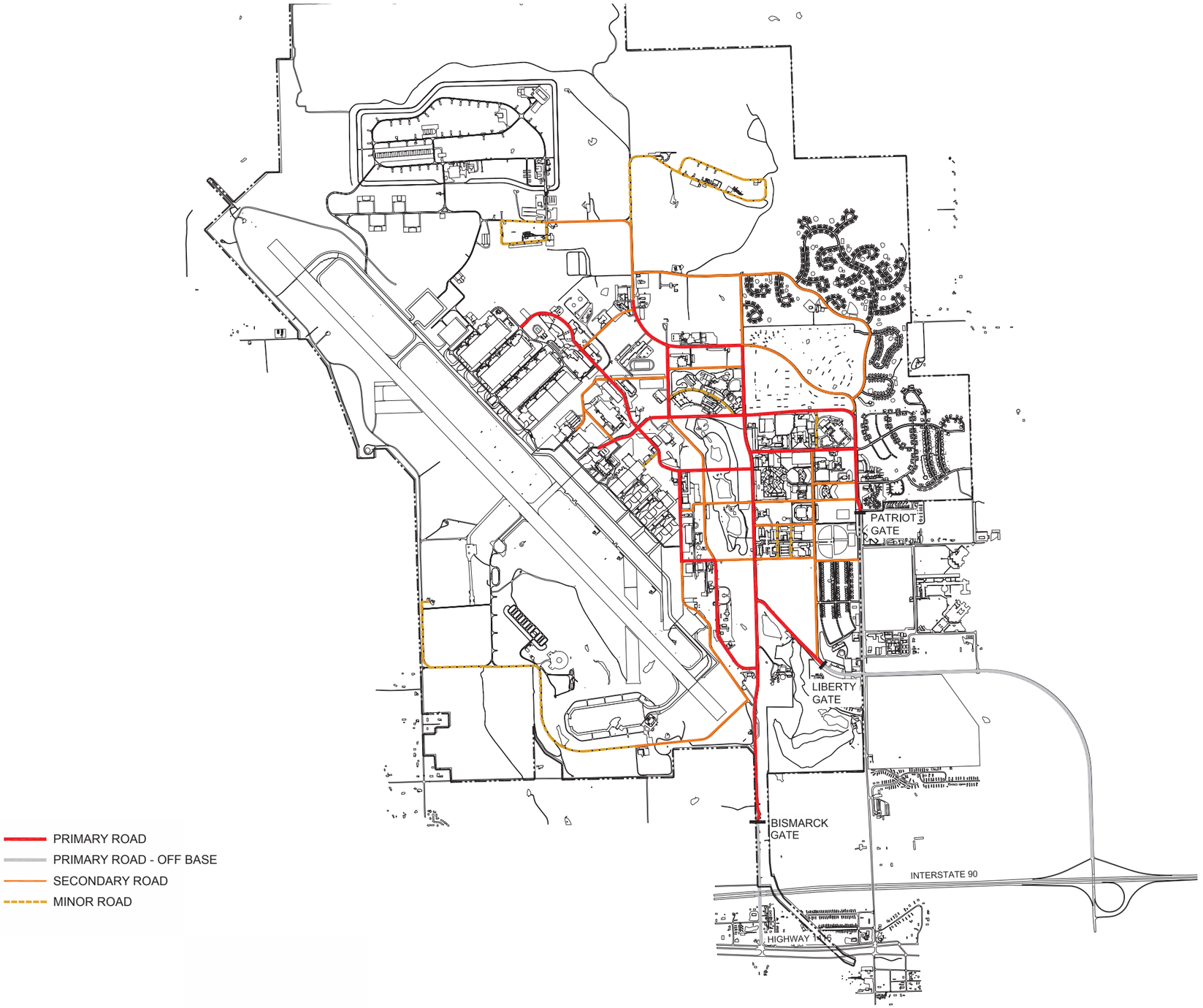


Figure 3.30
McConnell Blvd. to Connect Bergstrom and Ellsworth

The other area requiring improvement is access to the northwest portion of Bergstrom Drive. Currently, after passing Kenney Road, the northwest segment of Bergstrom Drive winds between a number of industrial and operational buildings before ending near the 37th Squadron Operations, 34th Squadron Operations, and MXG Headquarters buildings. Streets which extend east from Bergstrom Drive along this area do not provide a direct route to Ellsworth Street. A fairly direct relief route from Bergstrom Drive to Ellsworth Street could be created using McConnell Boulevard and Westover Avenue. This would require modifying the alignment of these streets to form a four-way intersection where they would cross Twinning Street, in place of the existing two "T" intersections on Twinning Street *(see Figure 3.30)*.

Minor streets that serve few land uses or carry small volumes of traffic should be considered for removal to create simpler traffic patterns, decrease the amount of pavement on Base, and help decrease long-term street maintenance costs. Ellsworth AFB has removed minor streets as part of past building demolition projects. Two minor streets that could be considered for removal are Boyington Street between George and



Existing Circulation Map

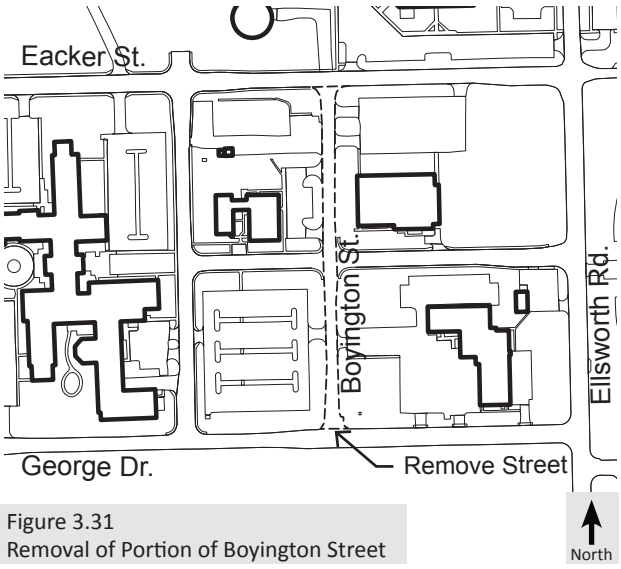


Figure 3.31
Removal of Portion of Boyington Street

Eaker Drives, and the portion of Rickenbacker Court extending from Bergstrom Drive to the street serving the B-1 Simulator building. The one-block section of Boyington Street provides access to several parking lots along it. In most cases, these entries could be closed and new entries constructed on either George or Eaker Drives *(see Figure 3.31)*. Removing the curved portion of Rickenbacker Court would create a large infill site along the east side of Bergstrom Drive *(see Figure 3.32)*.

Other opportunities should be examined where minor streets can be removed to decrease the amount of underutilized pavement on Base. As redevelopment and infill projects occur, street realignments should be

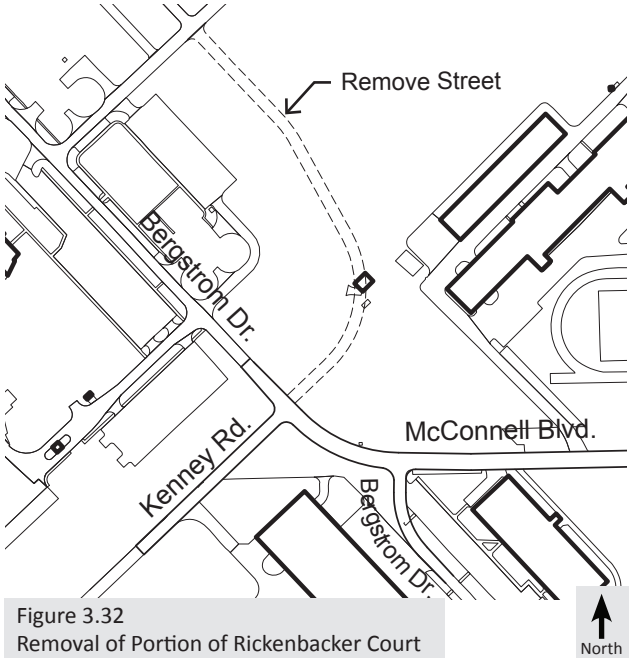


Figure 3.32
Removal of Portion of Rickenbacker Court

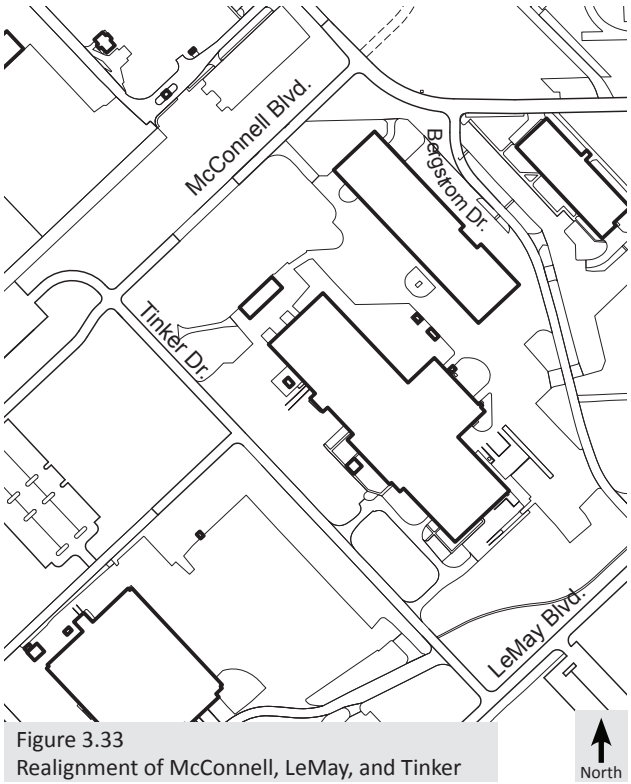


Figure 3.33
Realignment of McConnell, LeMay, and Tinker

considered. Realignment of the portions of McConnell and LeMay Boulevards west of Bergstrom Drive to intersect Tinker Drive would enhance the site of the Deployment Center addition to the Base Supply building. This change in street layout would create a more square parking area north of the Deployment Center and better serve the future AGE Shop to its west *(see Figure 3.33)*.

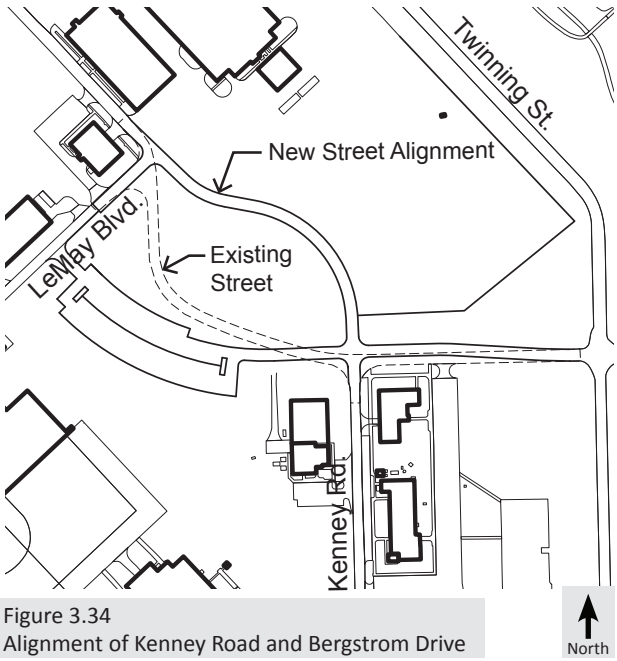


Figure 3.34
Alignment of Kenney Road and Bergstrom Drive

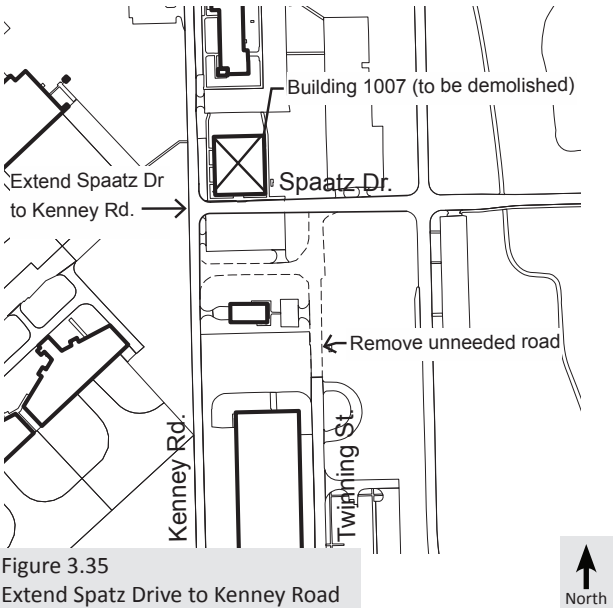


Figure 3.35
Extend Spatz Drive to Kenney Road

Another minor road alignment that would create two infill sites close to the flight line would be to realign the intersection of Kenney Road and Bergstrom to the east to make the through-movement from Kenney Road north onto Bergstrom Drive. The east-west extension of Bergstrom Drive would intersect the new road at a right angle, creating a "T" intersection *(see Figure 3.34)*. Demolition of Building 1007 may allow elimination of the jog in Spaatz Drive between Twinning Street and Kenney Road. A portion of the existing communication gear may remain in place once Building 1007 is demolished. It appears that sufficient space would exist to straighten this short road section *(see Figure 3.35)*.

Parking

Nearly all parking on Base occurs in off-street parking lots. A very limited amount of on-street parking occurs along Kenney Road in the industrial area. Most facilities at Ellsworth AFB have off-street parking lots. Parking for new facilities is designed to meet AT/FP standards. Base Civil Engineering has relocated existing parking which did not meet AT/FP standards for some existing facilities. Base Civil Engineering intends to relocate all non-conforming parking as funding becomes available.

The amount of parking on Base appears to be more than adequate. Ensuring that an adequate but not excessive amount of parking exists on Base is challenging, as mission and building use changes. New parking lot construction should be limited to meet requirements, and no more. Preferred parking near building entrances for car/vanpools and low-emitting vehicles should be included in all new construction projects. This strategy could also be applied to existing lots when they are restriped. It is typical to set aside five percent of total stalls for each of these user groups. This follows the intent of LEED. One additional strategy to consider is to install bicycle parking at all facilities to encourage biking to work, community facilities and for recreation. This simple improvement would improve the Base's sustainability, lower its carbon footprint, and help decrease both stormwater runoff and heat island effect.

- *Consider realigning the Ellsworth Street and Davis Drive intersection*
- *Consider creating a reliever road from Bergstrom Drive to Ellsworth Street*
- *Consider realigning the Kenney Road and Bergstrom Drive intersection*
- *Consider realigning Spaatz Drive between Kenney Road and Twinning Street*
- *Annually review minor low-use streets for possible removal*
- *Remove underutilized minor streets to create larger infill sites and/or to lower maintenance costs*
- *Remove any unneeded minor streets as infill or redevelopment occurs*
- *Continue to relocate parking which does not meet AT/FP standards as funds permit*
- *Remove excess and underutilized parking as funds permit*
- *Set aside 5% of parking for car/vanpools and 5% of parking for low-emitting vehicles in new and restriped lots*
- *Provide secure bicycle parking at all facilities*

Pedestrian Circulation

Sidewalks are absent from the flight line and industrial areas of the Base, except for walks connecting parking lots to building entries. Sidewalks parallel one or both sides of most roads in most of the area east of Ellsworth Street. In many cases the walk is placed directly behind the curb, which is less desirable from the pedestrian's vantage point. An exception to this condition is the walk that parallels the north side of Doolittle Drive. Here the walk is set back anywhere from 10 to 25 feet from the curb, creating a more pleasant and safer environment for the pedestrian.

The largest issue with walkways in the town center of Ellsworth AFB is the lack of continuity from block-to-

Figure 3.36
Proposed Pedestrian Spine Walkway

block. This, along with the placement of sidewalks adjacent to the street's edge, discourages pedestrian traffic. Since most of the sidewalks are associated with area streets, pedestrian circulation is circuitous, rather than point to point. A concept was developed earlier by a former Base Civil Engineering employee to create a pedestrian spine walk from George Drive north to LeMay Boulevard, which would follow the former alignment of Boyington Street. Most of this street has been abandoned as redevelopment has occurred along its route.

This pedestrian spine walkway could be located within a green corridor with sidewalk connections to adjacent buildings, large trees to provide shade, and seating areas to encourage interaction between pedestrians. This spine would pass through the heart of the Airmen's dormitories, connecting them to the proposed Professional Military Training Center, Arts & Crafts Center, Outdoor Recreation Center, Automobile Self-Help Shop, and Black Hills Chapel on the south, and the Exchange, Commissary, Library, and Movie Theater to the north. The northern terminus of this pedestrian spine walkway could be extended across LeMay Boulevard and continue throughout the family housing area to be redeveloped to the north. Spur walkways could be extended east and west of the main spine, to provide a quality pedestrian walking experience to the east-most Airmen's dormitory on Schriever Drive, the ballfield complex, Combined Club, AAFES Shopette, and the Temporary Lodging Facility *(see Figure 3.36)*.

A second east-west pedestrian spine walkway could be extended along the north and south sides of Doolittle Drive. At its eastern terminus on Ellsworth Road, this spine would connect to the adjacent family housing area. At its western terminus at Ellsworth Street, pedestrian crosswalks would connect it to the tail system in the Central Park Area. The east-west connection could serve as a bike trail, connecting families on its east end to the large park at its west end. Additional walkway connections along the east side of Ellsworth Road could connect the other family housing area further north to this pedestrian system.

Due to the length of the north-south and east-west pedestrian spines, it would be prudent to view them as potential bike trails as much as walkways. In this case, it would be good to allow bicycle, rollerblade, and skateboard use on them. A width of 10-feet is recommended for the main walkways to accommodate the proposed uses. The width for the spur walkways is recommended to be 6-feet. All walkways should be set back a minimum of 12-feet from the road edge. Clusters of trees should occur periodically along the walkways to provide areas of shade. Alternately, shade structures with seating could be provided at key locations along the spine trails to provide resting places.

- *Complete north-south and east-west pedestrian spine walkway and green corridor*
- *Provide shade along walkways with tree clusters or shade structures*
- *Move sidewalks away from road edges to improve the walking experience*
- *Connect walkway system to Fitness Center for physical training use*

Recreational Trails

Ellsworth AFB lacks a comprehensive trail system that could provide an alternate means of transportation for Base residents. The only trails that exist on Base are located in the Central Park Area. While interconnected, the trails there appear to have been developed as three separate projects. The trails extend from LeMay Boulevard south to George Drive. Two crosswalks provide access to the trails from the Fitness Center. Two additional crosswalks on Ellsworth Street provide access near the Rushmore Center and Freedom Chapel. Both of

these crosswalks occur mid-block and do not provide direct access to areas east of Ellsworth Street.

It was reported by Base Civil Engineering staff that trail use is very low. After examining the trail system, several recommendations can be made to improve the user experience and increase trail use. The trails run by, but not individually around, the series of ponds in the Central Park Area *(see Figure 3.37)*. People have a natural attraction to water. Additionally, the combination of water, trees, shrubs, and other vegetation make the ponds visually interesting and attractive. Adding segments that would make the trail encircle each of the ponds would increase use. This would transform the trail from a long linear route to a series of circular trails that are connected together by a linear trail.

Most of the bridges required to create loop trails around the ponds are in place. Picnic shelters and the playground adjacent to the ponds should be tied to the loop trails, with walks to provide accessibility and encourage use of these features *(see Figure 3.38)*. Parking exists at Spaatz Drive. Additional parking should be provided near LeMay Boulevard on the north, and George Drive. An existing parking lot associated with a demolished building exists just north of LeMay Boulevard. This lot could be designated for trail parking.

Tree clusters should be added along the trails, or shade structures should be constructed, to provide areas for trail visitors to get out of the sun. Signage should show the layout of the trail system and include information on trail grades and lengths. Having this information, visitors can select an appropriate trail to enjoy during their first visit. As their familiarity with the area increases during repeat visits, they can explore more of the trail system. Additional east-west connector trails should be extended at each intersection on Ellsworth Street. These would improve access to the trail and encourage dormitory residents, as well as office occupants along the east side of Ellsworth Street, to explore the trails in the Central Park Area.

- *Create a series of loop trails around existing pond system to increase use*
- *Extend spurs trails east to Ellsworth Street to encourage use*
- *Provide trail parking areas and information signs on trail grades and lengths*
- *Provide perimeter trail along Base fence line for long runs or bike rides (Security Forces may also benefit from having a trail along perimeter for patrol as well)*

Figure 3.38
Locate Picnic Shelters and other Recreational Activities along Trail System

Figure 3.37
Recreational Trail Located along Central Park Area

Figure 3.39
Commuter Bike Trail System allowing Existing Railroad Right-of-Way

Commuter Bike Trails

The opportunity exists to create an off-street bicycle trail utilizing a portion of the former railroad right-of-way that once served the Base. This trail could serve bicycle commuters by connecting two of the Base gates as well as the Airmen's Dormitory complex to the northern two-thirds of the flight line *(see Figure 3.39)*. The trail would begin at the Bismarck Gate and extend north on the former railbed. A spur would extend west from the Liberty Gate along Davis Drive to Ellsworth. The spur trail would extend across Ellsworth Street and continue west to where it would join the main trail. A second spur trail would connect to the Airmen's Dormitory complex. This trail would begin on the north side of Bergstrom Drive at Ellsworth Street and continue west to the former rail line. The trail would follow the rail line north to near Rickenbacker Court, where a new alignment could be developed to extend the trail to serve the two Squadron Operations buildings and the Maintenance Headquarters. On other similar projects, the salvage value of the steel rails has been used to offset the cost of surfacing the trail.

A third spur trail could be extended west along the north side of LeMay Boulevard to the Pride Hangar to provide access to it, the Fire Station, and the Airfield Operations building.

- *Develop a commuter bike trail on the former rail line*
- *Develop a series of spur trails to increase the number of facilities served*

On-Street Bike Trails

The creation of on-street bike trails should be explored at Ellsworth AFB. Implementing a "share the road" system could increase bicycle commuting and decrease the number of intra-base vehicle trips *(see Figure 3.40)*. While the perception is that existing roads are too narrow to accommodate both bicycle and vehicle traffic, a planning process that includes interested bicyclists could identify potential bike routes and set the stage for a mind change on this topic. If installations without public transportation are to be sustainable, new approaches to intra-base transportation have to be explored.

- *Develop a "share the road" on-street bike trail system at Ellsworth AFB*
- *Create Commander's Bike-Pedestrian Committee to foster off- and on-street trail development*

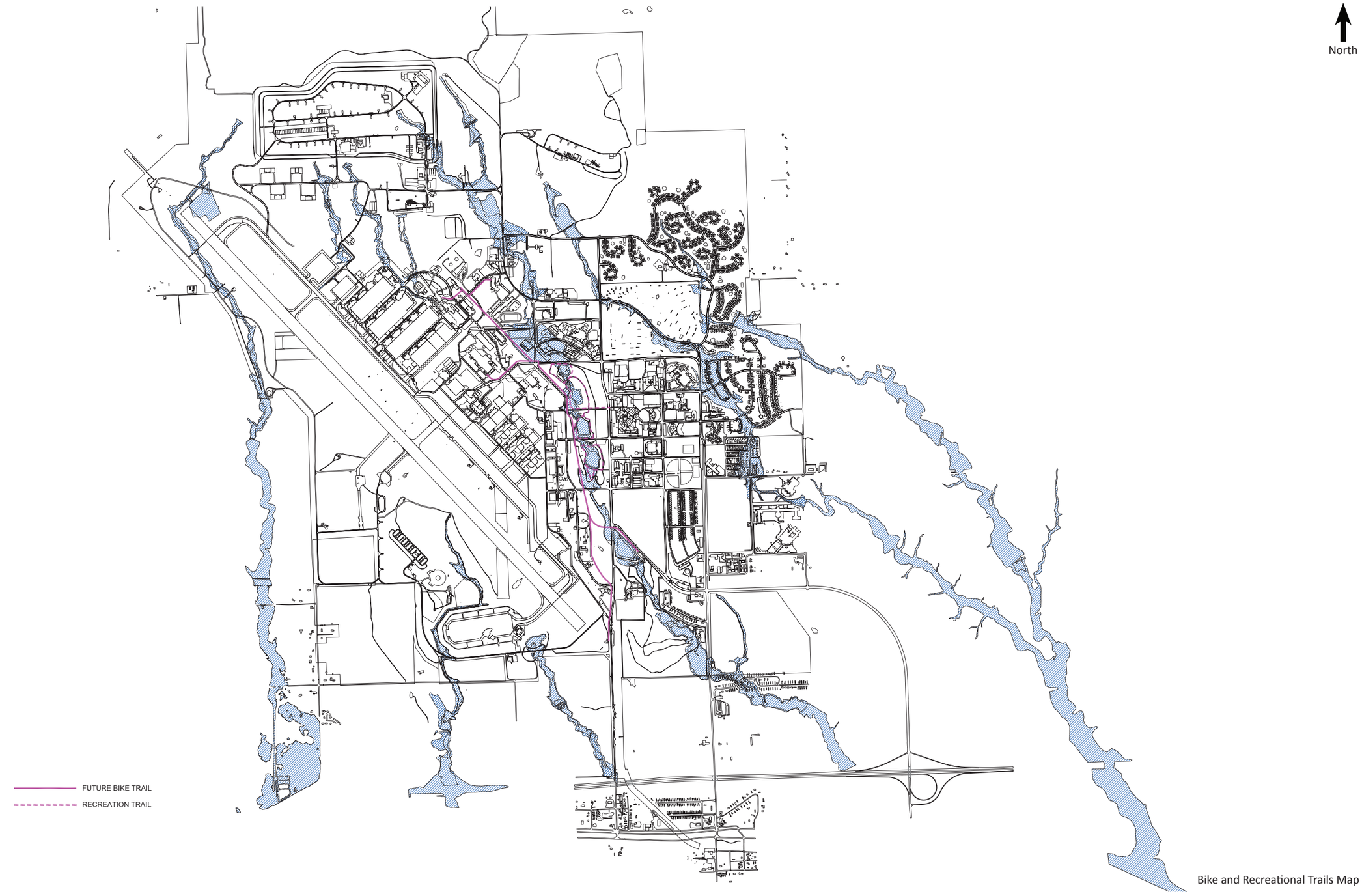
Rapid City Regional Trail System

Rapid City is currently developing a community-wide bicycle and pedestrian master plan. The draft plan's recommendations include development of a regional system of trails to connect Rapid City to nearby communities using bike trails. One proposed trail, named the Railroad Trail, would parallel the existing railroad line that extends east through Box Elder. If the Railroad Trail was constructed all the way east to Box Elder, a spur trail could be built to run north along Ellsworth Street providing a connection to the Base.

Base leadership has actively engaged the community of Box Elder, South Dakota Department of Transportation, and other local governments, to ensure that safe and efficient roads serve the Base, connecting it to the larger, regional vehicular transportation system. Base leadership should take the same proactive stance to help ensure that a multi-modal (vehicle/bicycle/pedestrian) transportation system is developed to connect Ellsworth AFB to adjacent communities.

- *Base leadership should review and comment on the draft bicycle and pedestrian master plan*
- *Base leadership should encourage local communities and state government to include the proposed Railroad Trail to Box Elder with a spur trail to Ellsworth AFB in regional transportation plans*

Figure 3.40
Example of Bike Lane on Shared Road



Bike and Recreational Trails Map

[3.4] Utilities

Power, communications, natural gas, potable water, and sanitary sewer services are available throughout the Ellsworth AFB's developed areas. Utilities on Base generally parallel roadways. There is no identified constraint regarding the availability of utilities relative to current levels of use or future expansion.

Electric power for the Base is supplied from a regional transmission line that runs north of the Base. A transmission line spur extends south into the Base, terminating at a substation located just west of the Wing Headquarters. Distribution of power occurs through a collection of overhead and underground electric distribution lines. Power lines have been buried on sites with recent development and around high-visibility facilities, like the Wing Headquarters and major operations buildings.

The vast majority of buildings at Ellsworth AFB have stand-alone heating and cooling systems. The Base's low density of buildings decreases the feasibility of creating a central heating or cooling plant. Potential to utilize geothermal heating systems exists on the Base. The Madison Aquifer, which extends under the Base at a depth of about 3,500 feet, has a water temperature ranging from 120 to 130 degrees (F). Closed-loop wells extending down to this geologic feature could harvest heat from it for use in heating buildings. However, an engineering evaluation should be made prior to any implementation of geothermal heating systems for new or existing buildings.

The Installation's potable water supply and stormwater drainage system are discussed in Section 5.1 SUSTAINABLE DEVELOPMENT AND HIGH PERFORMANCE GREEN BUILDINGS.

[3.5] Land Use

Land use at Ellsworth AFB is fairly homogenous along the flight line and adjacent industrial area. East of these areas, several land uses intermingle, with the exception of the family housing areas which occur along the eastern and northeastern edges of the Installation. A key natural feature that influences Ellsworth AFB's land use is a large, north-south drainageway between the flight line/industrial area and the remainder of the Base's developed areas *(see Figure 3.41)*. This stream valley has been preserved as permanent open space. Buildings and side roads, which once were located in the area, have been removed to enlarge and create the Central Park Area that serves as a strong organizing element for the Base's land use.

Figure 3.41
Central Park Drainageway

Consistent mission-related land uses occur along the flight line. A historic cast-in-place concrete hangar, the Pride Hangar, is temporarily being used as an indoor physical fitness center, to assist in maintaining and preserving the building for future use in a yet-to-be identified mission. The industrial area runs along the eastern edge of the flight line. The land use in this area is nearly all mission-support related, with the exception of two minor land uses. A heritage area exists that includes a former missile training facility. The training facility is no longer used for a military purpose, but is used for tours by the local air and space museum. The other feature is a football field and track facility located south of the Base CE Shops complex. Neither of these uses negatively impact the surrounding land uses.

The Base's north central area, between Twinning and Ellsworth Streets on its east and west sides, and LeMay Boulevard on its south, has an interesting mixture of land uses that while varied, are compatible. The Wing and Operations Group Headquarters occur on the northern edge of this area, with undeveloped land to the north of these buildings. On the block to the south are an older


North
FLIGHTLINE
INDUSTRIAL
ADMINISTRATIVE/EDUCATION/COMMUNICATIONS
COMMUNITY COMMERCIAL & SERVICES
HOSPITAL
FAMILY HOUSING
AIRMEN HOUSING
OUTDOOR RECREATION AREAS
DESIGNATED OPEN SPACE & HERITAGE AREAS
FLOODPLAINS
GOLF COURSE

Land Use Map

Figure 3.42
Incorporate Airmen Dormitories with Town Center Land Use Area

maintenance training facility, some open ground, and the Base Teen Center. Further south is the Base Fitness Center, outdoor swimming pool, a building containing the Youth Center, a temporary lodging facility, and some outdoor recreation areas. When analyzing this land use pattern relative to the larger base, it becomes apparent that the Teen Center is out of place, due to its isolation from family housing areas and other community service buildings. The eventual demolition of the maintenance facility and probable relocation of the Youth Center to a more central location in the town center would open a large area across from the Headquarters buildings for an administrative use, or for further expansion of sportsfields or outdoor recreation facilities associated with the Fitness Center.

The eastern third of the Base has three family residential areas on its northeast corner and a smaller family housing area on its southeast corner. A large undeveloped area exists at its southern end, extending to near the Liberty Gate. At the center of this area is a mixture of Airmen's dormitories; community commercial and community services; administrative, educational, religious, communication, and medical land uses. These intermingled land uses are representative of the land uses that often occur in the downtown and downtown periphery area of civilian communities. The land uses are generally compatible and could serve as the basis for creating the appearance and feel of "downtown" Ellsworth AFB. Outdoor sports fields occur along the eastern edge of the downtown area, and the Base's central park borders its western edge. The core area includes the Base Hospital, Exchange and Commissary, Movie Theater, Library, two Chapels, a Religious Education building, the Bowling Alley, Arts and Crafts Center, and Self-Help Vehicle Repair Shop. The Rushmore Center, an Air Force Finance complex, Security Services, Training Services, and a Communications building are also located in this area.

The largest impediment to converting this fairly compact urban area into a "walkable neighborhood" is the high density of streets and large number of parking lots in the area. Creating pedestrian circulation routes and tying these routes to both the adjacent parks and family housing areas could improve the quality of life for Base residents and increase the likelihood that residents would walk from place to place rather than drive *(see Figure 3.42)*. The potential exists to create a pedestrian spine walkway and green corridor that would extend from the undeveloped site at the core area's south end to the Exchange/Commissary node on its north end. To make this spine successful, existing buildings would need to be refocused onto it; new buildings in the area designed to relate to it; and area parking lots removed or redesigned to create a continuous green space. The creation of a second east-west trail corridor, which could run along an existing road, is essential. This east-west pedestrian connection would tie the family housing area on its east end and the Central Park Area on its west end to the town center *(see Figure 3.36)*.

A large vacant area of land exists in the southwest corner of the Base. This area is west of the runway and associated facilities. The area could be used to bed-down a new major mission. This site is identified as Infill Area #5 in Section 3.2 INFILL OPPORTUNITIES.

- *Add sidewalks to create a walkable neighborhood near the center of the Base*
- *Construct north-south and east-west pedestrian spine walkways to create a "Town Center"*
- *Infill spaces along the spine with land uses that generate pedestrians, not vehicle traffic*
- *Locate any additional AAFES facilities next to the existing Shopette and not next to the Air Force finance complex*
- *Infill uses proposed in this ID2 will reinforce existing land use patterns*
- *Space exists southwest of the runway to accommodate a new major mission*

[3.6] Constraints

The Installation's gently sloping topography made the site attractive for use as an airfield. Most of the Base's land area slopes towards the southeast. One large and several smaller intermittent streams drain this area to Box Elder Creek, which originates in the Black Hills to the west. A narrow band of land along the Base's north edge slopes steeply down to the north. Several small drainage ways flow north to Elk Creek, another regional stream. Constraints related to natural resources are fairly limited relative to continued development of the Base.

Cultural constraints are a larger concern at Ellsworth AFB due to its proximity to the village of Box Elder, and to Rapid City a few miles to the west. Ellsworth AFB and adjoining local governments have addressed these concerns by creating several collective planning documents that address both transportation and land use issues. Each plan is intended to limit the adverse impacts that either the Base or adjacent communities have on the other entity, while ensuring coordination on issues like development of area roads and highways.

Natural Resource-Related Constraints

Natural resource-related constraints that could impact future development, and strategies to minimize their impact, include:

Potable Water Supply
While the Base's water supply is legally defined as unlimited, continued growth in Rapid City and the central Black Hills area, along with changing climatic conditions, could affect the volume of water available in the Rapid Creek watershed. Disruption or damage to the Base's supply pipeline could eliminate the Base's supply without notice. An alternate source of water to the Base would be a great addition to improve reliability and sustainability. Currently the Base has a project to drill a well to create a secondary supply, but is waiting for funding. Efficient water use is important in minimizing future water issues.

- *Use potable water efficiently*
- *Avoid use of potable water for landscape irrigation*
- *Explore alternate supplies of potable water for the Base*

Floodplains
Several intermittent streams run from northwest to southeast across the Base's developed area. The largest of these is the stream that runs between Ellsworth and Twinning Streets through the Central Park Area. The upper reaches of this stream and several others begin just north of the Base's developed area and flow southeast through the Base cantonment. Portions of the upper reaches of these streams are potential expansion areas for new facilities related to aircraft ordnance handling and maintenance. Since these areas are in the stream headwaters, flooding associated with them is likely to be less than a foot in depth and will occur for a fairly brief period, since flow is unimpeded to the south. Best practices in land use planning recommend avoiding development in floodplain areas. Currently Base CE is having a study completed to better define flood depths and extents in these areas.

- *Complete current floodplain study*
- *Avoid development in floodplain areas*
- *Preserve floodplain areas as green space and locations for stormwater Best Management Practices (BMPs) where possible*
- *When development must be sited in floodplain areas, provide compensatory green areas that can accommodate required flow volumes*

Landscape Irrigation Water
Irrigation is essential for the establishment of landscape plantings at Ellsworth AFB and on-going plant vigor during times of extended drought. Using potable water for landscape irrigation is at odds with larger sustainability. Currently the Base is in the process of eliminating all irrigation systems that water turfgrass lawn areas *(see Figure 3.43)*.

Use of greywater for irrigation of lawns and areas not used for food production is allowed by the regulations of the South Dakota Department of Environment and Natural Resources. When the Base's wastewater treatment plant is replaced by the proposed regional treatment plant, the feasibility of creating a pipeline from the plant to the Base to provide greywater for irrigation purposes should be explored.

- *Irrigate landscape areas with harvested rainwater or greywater*
- *Investigate feasibility of constructing pipeline to transport fully-treated effluent from proposed regional wastewater treatment plant to Base in the future*

Existing Constraints

Stormwater Management
High intensity, short duration rainstorms create temporary ponding and overland flows in some areas.

- *Stormwater should be viewed as a resource, not a nuisance*
- *Appropriately-sized infiltration BMP's (rain gardens, bioretention cells, infiltration trenches) should be included in new project designs and retrofitted into areas where drainage problems exist*

Cultural Resource-Related Constraints

Cultural resource-related constraints that could impact future development, and strategies to minimize their impact, include:

Continuing "Green Field" Growth
On-going Installation development at the perimeter of the flight line and industrial area occupies all available land, eliminating options that may be needed to bed-down future missions. On-going expansion results in a low-density installation, increasing infrastructure and road development costs, as well as on-going maintenance costs.

- *Examine available infill sites as "first choice" for new facilities*
- *Prioritize infill sites for reuse*
- *Consider opportunity costs when siting new facilities – Is this facility, the best long-term use for this site?*

Traffic impacts along SD 1416 through Box Elder
Relocation of the Interstate 90 interchange from Ellsworth Road to Liberty Boulevard to serve the main gate (Liberty Gate) has resulted in some Base workers and residents exiting the interstate west of the village of Box Elder and traveling SD Highway 1416 through the community to reach the south gate (Bismarck Gate). A traffic study was completed to determine the negative traffic impacts of this change.

- *Fully implement the recommendations of the traffic study to improve safety with Box Elder*
- *Consider conversion of the Bismarck Gate to serve only commercial traffic, to encourage eastbound traffic to remain on I-90 to the Liberty Road exit.*

[3.7] Green Infrastructure

Green infrastructure enhances the quality of life for people while mitigating negative impacts associated with land development and operations *(see Figure 3.43)*. Existing parks, open space, undisturbed vacant land, natural drainages and the Installation's landscape plantings comprise Ellsworth AFB's green infrastructure. The Installation is located on the semi-arid plains east of the Black Hills. While temperature microclimates occur within the Black Hills, Ellsworth AFB is exposed to the harsh climate of the High Plains. Use of native plant species adapted to the area will improve success of green infrastructure at Ellsworth AFB *(see Figure 3.44)*. Supplemental moisture is needed to improve the survival rate of plantings during establishment, and may be needed during extended times of drought to protect the investment in the Installation's green infrastructure.

- *Innovative irrigation water sources, including harvested rainwater and reuse of grey water, should be pursued to conserve potable water sources*

Figure 3.44
Native Vegetation Reduces Need for Irrigation on Base

Significant Parks and Green Spaces

The harsh and relatively dry climate at Ellsworth AFB creates a challenge in the development of green spaces. Supplemental irrigation is required to successfully establish landscape plantings and maintain green spaces with turfgrass lawns during drier periods of the year.

Central Park Area
The Installation's premier green space is the Central Park Area, beginning at LeMay Boulevard and extending to the south edge of the Base between

Figure 3.43
Air Force Financial Services Facility: Courtyard Greenspace

Ellsworth and Twinning Streets. This open space separates the working portion of the Base from the town center and housing areas. It provides several ecological functions, serving as a floodway corridor, producing oxygen, and buffering aircraft noise. The area's series of ponds increase diversity of the local landscape and improve its visual character. This open space should be enhanced by adding tree plantings, to provide shade and to screen the view of the adjoining industrial land uses. A band of vegetation should be left un-mowed along the creek to filter sediment from stormwater flowing overland to the creek, and serve as a wildlife corridor along the creek.

- *Manage the Central Park Area to provide Base residents with a large continuous open space with walking trails, fishing opportunities, and a corridor for watching birds and wildlife.*
- *Add groups of trees to provide shade for park visitors, buffer wind, and screen industrial land uses.*

Fitness Center Park Area
A green space occurs on the north side of the Fitness Center that includes play equipment, landscape plantings, loop walking trail, group shelter, tennis courts, and a skateboard park. A large number of conifer trees have been planted in this area. Additional deciduous trees are needed to provide shade for park visitors.

- *Add deciduous plantings to the park to provide shade for park visitors and buffer wind.*
- *Expand the group shelter for use by the Base community.*

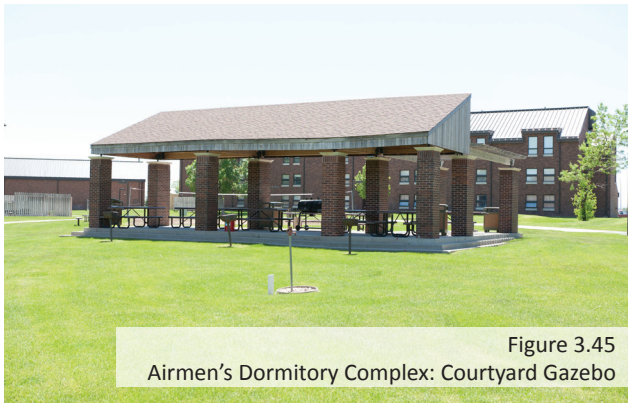


Figure 3.45
Airmen's Dormitory Complex: Courtyard Gazebo

Airmen's Dormitory Courtyard
A large linear green space exists between the west cluster of Airmen's Dormitories (Buildings 2204, 2205, 3603 and 3606). This open space has the potential to act as an important social space for dormitory residents *(see Figure 3.45)*. Currently it appears to be seldom used by dormitory residents. The partial enclosure provided by the multi-story dormitories should help create a microclimate conducive to improved plant growth and supportive of use by human occupants. The buildings block winds, provide shade, and define exterior space. Currently the main feature of this area is a wide concrete walk which bisects the open space from end to end, providing an ease of access for security services and maintenance staff. This, however, detracts from the space's ability to function as green space. A picnic shelter and sand volleyball court are located in the green space. Large air conditioning units and scattered foundation plantings are the courtyard's other features. A redesign of this green space should include tree clusters that provide shade and define the space into a series of outdoor rooms.

- *Redesign the dormitory courtyard, and outdoor areas at other dormitories, to provide inviting outdoor space that will encourage healthful outdoor activities and social interaction.*
- *Visually screen air conditioning units and provide sound buffering if needed.*
- *Create diverse and attractive plantings in the courtyard and areas surrounding the buildings.*

Other Green Spaces

Other areas of green space occur at Ellsworth AFB but are not as easily identifiable as green spaces. Key areas that would benefit from landscape development include the following:

Entry Road Plantings along Davis Drive and Ellsworth Street from the Liberty Gate to George Drive
This corridor should be improved to offer a more welcoming appearance. The fishing pond on the south side of Davis Drive has an inviting appearance but the remainder of the corridor does not.

- *Groups of trees along this corridor could define it as an important community entry.*
- *On the west side of Ellsworth Street, the tree groups could be located along the creek to improve its appearance and provide a natural source of moisture.*

Proposed North-South and East-West Pedestrian Spine Walks
Each of these walkways should occur within a green corridor that provides visual interest, shade, and buffers the ever-present prairie wind.

Sports Fields
The complex of sportsfields on the Base's eastern edge would benefit from planting of conifers and shade trees to buffer wind and provide shade for individuals and families using the complex.

- *Provide shade trees around the field perimeters to provide shade and better define the playing areas.*
- *Provide shade trees along area streets to shade cars*

Significant Green Resources

Certain green infrastructure resources extend beyond a single park or building site. These resources provide benefits that extend throughout an installation. The proper approach to managing these green resources is to make decisions on a community- or area-wide basis, rather than at the site level.

Mature Tree Canopy in Family Housing area to be Redeveloped
A large number of mature trees exist in the former family housing area that is located north of the town center. This area will be redeveloped as a new family housing area. The mature trees should be preserved as part of the design of this area. Ellsworth AFB should require that the project designer and project contractor each employ an urban forester or

landscape architect experienced in tree preservation during the family housing design and construction process. The forester or landscape architect should closely monitor construction activities throughout the entire construction process.

Ellsworth AFB Urban Forest

Tree planting should be an annual occurrence at Ellsworth AFB, to create a forest that has a diverse number of tree and shrub species of various ages. While the palette of plants that can survive at Ellsworth AFB is not large, the urban forest should include all species of trees that will successfully grow on the site, except for species that are known to be invasive.

Trees planted along streets would enhance the aesthetic character of the entire Base and provide important services, like reducing the amount of rainfall reaching the ground to decrease stormwater runoff, shading pavement and walks to reduce the heat island effect, and lowering glare from vehicles and lights. Systematic plantings of street trees should be implemented across Ellsworth AFB in areas where it is appropriate. A Street Tree Master Plan should be developed to guide this effort and provide a mechanism to ensure a diverse street tree collection.

The Base's street tree collection should extend into all POV parking areas. Tree islands in parking lots can dramatically improve local microclimates and assist in achieving the stormwater management requirements of Section 438 of the Energy Independence and Security Act. Section 5.2 SITE DEVELOPMENT has additional information and recommendations on how best to include tree islands and other green infrastructure in parking lots.

- *Actively manage Ellsworth AFB's urban forest to protect the health of its trees and shrubs.*
- *Increase the diversity of species through new tree and shrub plantings.*
- *Creating a forest of trees of all ages by annual tree planting should be a priority.*
- *Implement a Base-wide street tree system that incorporates the goals of an urban forest.*
- *Create a Base Street Tree Master Plan.*
- *Extend the street collection into parking lots.*
- *Protect the mature trees in the former family housing redevelopment area.*

Figure 3.46
Rushmore Center: Courtyard Area

Building Courtyards

Open-air courtyards designed as part of a building's form can create a pleasant outdoor space. The protection provided by the building makes these areas less windy, and partially shaded courtyards promote plant growth, causing increases in local humidity and human comfort *(see Figure 3.46)*. These areas have a longer season of use throughout the year because of the microclimates created by the interplay of outdoor space and the adjacent building.

- *New building projects should consider how building form and footprint could create viable outdoor spaces, integrating these spaces into the building design rather than simply attaching an outdoor space near an entry or at one end*

Scattered Landscape Areas within the Flight line and Industrial Areas

New building projects should consider how building form and footprint could create viable outdoor spaces, integrating these spaces into the building design rather than simply attaching an outdoor space near an entry or at one end

- *These spaces stand out within this highly developed area.*
- *Plantings around existing buildings should be managed to extend their effective life.*
- *Plantings that occurred near buildings that have been demolished should be preserved, if possible, when new uses are located on those sites.*
- *New plantings should be included as part of new construction and major renovation projects within this zone, to extend the benefits of green infrastructure throughout the Installation.*

Recently Completed MILCON and Renovation Projects with Landscape Plantings

Green infrastructure is needed on new construction projects to comply with several Executive Orders regarding sustainable design. Stormwater quality and quantity issues can be cost-effectively addressed using bioretention and bio-infiltration plantings.

- *All Installation building and infrastructure construction projects which are located outside of the operational side of the flight line should incorporate green infrastructure.*

Undeveloped Land Surrounding the Installation's Developed Area

The natural areas surrounding the built-up portion of the Installation should be viewed as providing green ecologic services to the Base *(see Figure 3.47)*. These plantings hold soil in place, reduce the erosion power of stormwater, provide wildlife habitat and food, sequester carbon dioxide, and release oxygen.

- *Degraded areas of native vegetation should be restored to maximize the value of services these areas provide to the residents and employees at the Base.*

Future of Golf Course Irrigation Source

The existing golf course was purposely not included in the green infrastructure listing. The course's tee boxes, fairways and greens are clothed with green, irrigated grass and the course is a recreational resource. These factors do not, however, imply that the course provides any environmental benefits beyond the golf course's boundary.

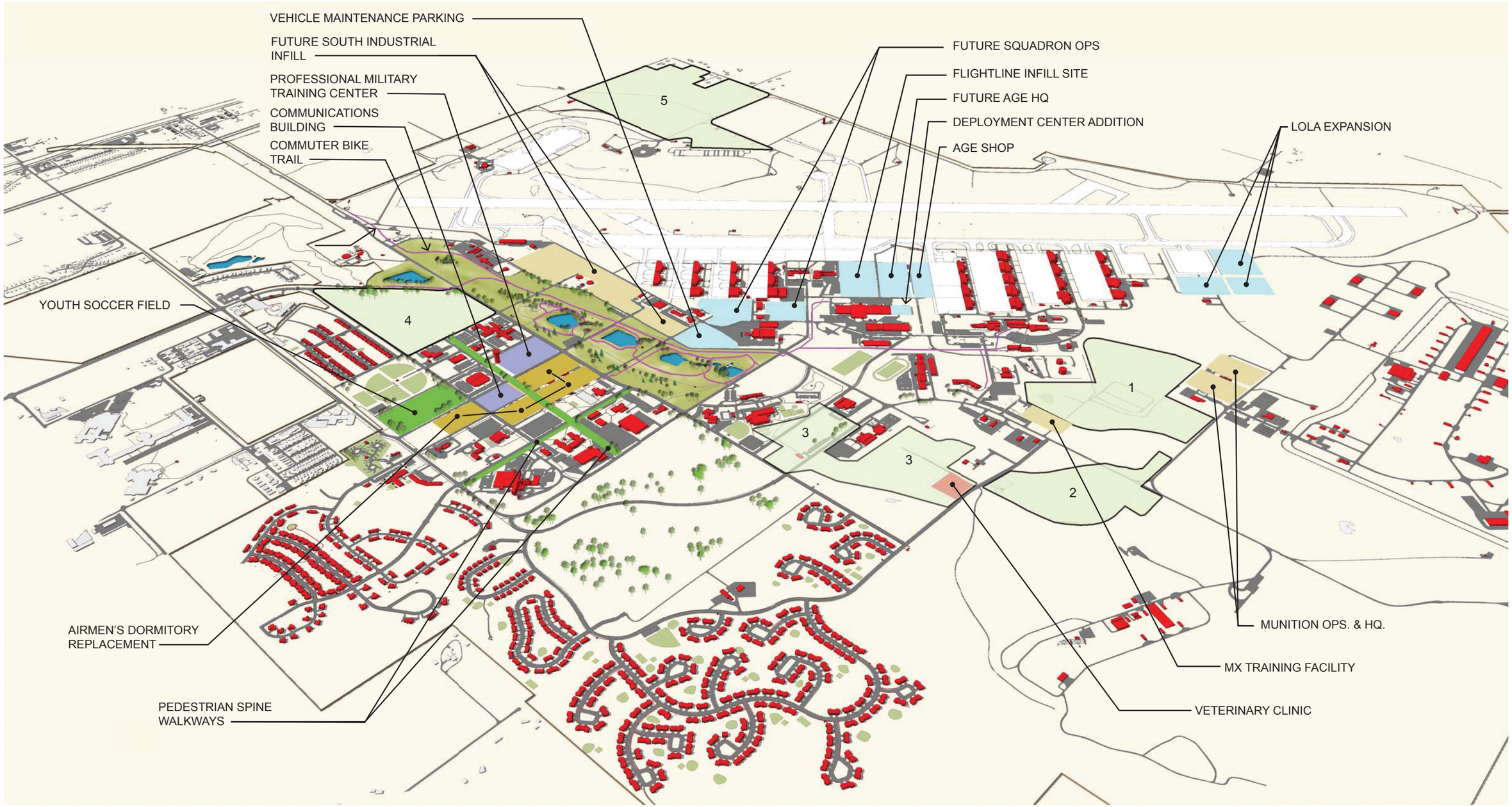
When the Base's wastewater treatment plant is replaced by the regional treatment plan, the opportunity to use treated effluent for irrigating the golf course will be eliminated. Use of potable water for this purpose is not sustainable nor environmentally sound. Discussion regarding the golf course's future should occur now so that an alternate source of water can be identified, plans can be made to suspend operation of the course, or the development of a golf course using native grass species that do not require irrigation can be implemented. Also, five of the course's holes are currently located in the runway's south clear zone. Box Elder community leaders would like to construct a municipal golf course to replace the Base course if the Base course is closed.

- *Create a series of scenarios on how best to address the loss of treated effluent for use in irrigating the golf course.*
- *Pursue new ideas on how to create a sustainable course.*
- *Explore options with Box Elder community leaders on a possible municipal golf course to replace the Base course.*

Figure 3.47
Base Operations Facility: Restored Native Grass Landscape

[4.1] Illustrative Plan

The purpose of this section is to graphically illustrate the desired future state of the Installation at both a macro and micro scale. The key element of this section is the Illustrative Plan showing the desired changes in the Installation image elements, and the resultant urban form achieved following the ID2 guidelines. Building footprints, roadways, parking areas, and pathways are illustrated. The following Illustrative Plan highlights the establishment of nodes, landmarks, and links that create the future vision of the Main Base and Flight Line areas. Future development has been depicted in symbolic or notational form to guide implementation of new Base needs.



Illustrative Plan

[5.1] Sustainable Development & High Performance Green Buildings

Ellsworth AFB uses the ACC Sustainable Design & High Performance Green Buildings (SD&HPGB) Scorecard as its green building self-assessment metric. The Scorecard assembles and consolidates Executive Orders, Public Laws, and Federal Agency rulemaking on SD&HPGB requirements with the LEED Rating System. Using the Scorecard is a way to achieve the desired LEED rating and meet critical statutory minimum requirements.

When applied in context, the Scorecard can illuminate opportunities for sustainable design, often with low- or no-cost choices. Some choices carry an upfront cost but provide long-term operational cost savings and are value-added building features. Scorecard requirements can guide and inform building projects towards lower lifecycle costs and enhanced sustainability.

To be successful, sustainable development needs to fit within the parameters of the natural environment where it is located. Similarly, successful high performance green buildings need to be designed and sited with regional location, local climate, orientation, and surrounding land uses in mind. Existing development at Ellsworth AFB will influence the degree to which new facilities can be placed to meet optimal building siting criteria. Designers of new facilities should accept these limitations as challenges to be dealt with creatively during the design process.

Ellsworth AFB is located in an environment that has moderate temperatures in the summer along with low humidity. As such, operable windows can allow natural ventilation during all but inclimate weather, without humidity becoming an issue. Another added benefit of this moderate summer climate is that the breezes and low humidity allow natural evaporative cooling of people, so outdoor areas that are shaded and partially sheltered from the wind afford an extension of the interior environment into the outdoors, especially when located next to buildings, where the users are able to access them readily. And there are reasons to provide roofs with high solar reflectance indexes (SRI) at this Base, because even though the winters can be harsh, with the proliferation of electronic equipment within facilities, the cooling degree days still outnumber the heating degree days.

Energy-efficient buildings can be achieved by proper building orientation; utilizing thermally-enhanced wall and roof construction; careful selection of HVAC systems that incorporate the use of energy recovery and free cooling; and careful attention to sealing

Figure 5.1
Central Park Area Drainageway

the building envelope. Every facility should be designed with an analysis on life cycle cost of various optional HVAC systems, including the possible use of geothermal systems.

Building orientation should take into account the prevailing winds and sun angles, and building fenestration should take advantage of these natural resources. Operable windows can be utilized during the spring, summer, and fall, because of the relatively cool temperatures and low humidity of the region. And every building should be designed with the idea that daylight and views should be available to all the occupants, as much as functionally possible. Transfer of daylight internally via clerestory windows, transoms, and glass lites is encouraged. Appropriate sun control measures should be incorporated into designs, to limit heat gain and glare within the facility.

Buildings should be designed to eliminate the proliferation of refrigerators, microwaves, copiers, and high-volume printers that populate most office and workstation environments. Instead, work toward solutions that economize by designing a few common work areas that incorporate these items to serve multiple users. Energy use is reduced, fumes can be removed properly, and these work areas can also serve as appropriate places to locate the necessary recycling centers.

Ellsworth AFB obtains all of its potable water from the Rapid City municipal water system. Under the agreement, there is no limit to the amount of water that Ellsworth AFB can receive at no cost, except for the costs incurred by Rapid City for conveyance and treatment (Ellsworth General Plan – 4.B.3 Water System). The City's water source is a series of reservoirs constructed within the portion of the Rapid Creek watershed that is located within the Black Hills. The Base is currently investigating the feasibility of having access to a second water source, in case there is a disruption in the Rapid City water system. This would be accomplished by creating a connection to the City of Box Elder's water system.

Even with a seemingly adequate supply of water in place, strategies to prevent current or future overuse of this precious resource should be considered in all new development and green building projects. Water saving features should be incorporated into facility designs as much as possible. Use of waterless urinals, low flow fixtures, and HVAC systems that minimize water use are all strategies to consider for decreasing interior water use.

Irrigation of landscape plantings is the other major water use at Ellsworth AFB. According to Base Civil Engineering staff, during years with normal or above average rainfall, well established plantings can survive without supplemental moisture provided by landscape irrigation systems. During a single dry year, the plantings will survive, although their vigor would be decreased and lawn areas would become dormant. During extended periods of drought lasting several years, many of these landscape plantings would decline and die. No tree or shrub species are native to Ellsworth AFB, with the exception of scattered willows and cottonwood trees that might have existed along drainage ways near the Base's southern edge by Box Elder Creek. On most of Ellsworth AFB, the native landscape consisted of short-and mid-height native grasses well-adapted to the variance in climate *(see Figure 5.1)*.

A strategy for landscape plant selection would be to use regionally native plant species along with supplemental irrigation during their establishment period. USGBC criteria allows irrigation for a two-year period; however regional experience would indicate that using irrigation for a three-year establishment period would provide a greater level of success. Irrigation systems that are installed to aid in establishment of plantings should be disconnected after that period but left in place. This strategy would allow reconnection and temporary use of the irrigation system in the future to save the plantings during an extended time of drought.

To create a sustainable landscape for the Base's public open spaces, parks, sports fields, and other prominent community areas, the need to use potable water for landscape irrigation must be minimized. Rainwater collection systems from building roofs could be used to supply cisterns that could serve as irrigation water sources. The possible use of grey water for landscape irrigation should be explored on a project-by-project basis. Grey water from hand washing and other minor uses could be collected and stored for use as irrigation water. The irrigation method will need to take the presence of soaps and other sediment into consideration when the system is designed. State of South Dakota regulations allow the use of greywater for irrigating lawns and areas not used for food production. Diverting water from paved surfaces onto lawn areas or into parking lot islands may be another strategy to use runoff as a resource. Long-term, it will be the responsibility of Base Civil Engineering and the designers of all new facilities to ensure that the Base's landscape is

developed in a manner which minimizes or eliminates the use of potable water for irrigation.

Figure 5.2
Example of Linear Bioretention Garden

Where irrigation systems are used, irrigation controllers that are connected to weather data should be required. These controllers use National Weather Service data to calculate moisture needs. Additionally, soil moisture monitors can be installed and connected to the controllers to further improve their performance.

Most of Ellsworth AFB's annual precipitation occurs during the months of April through September (Ellsworth General Plan – 4.A.3.1.16 Climate & Weather). Many of the local rainstorms occur as high-intensity, short duration storms. The flight line and most of the industrial area is served by underground stormwater drainage systems which outlet upstream of two ponds, near the southern edge of the Base. The remainder of the Base's built-up area is served by a number of smaller drainage systems which include sections of underground pipe and open ditches. Most of this run-off is directed to the drainageway which runs through the center of Ellsworth AFB, and contains a series of six ponds. The pond system was recently renovated to remove sediment, correct erosion problems, and improve its ability to handle large storm flows. The performance of this system could be further enhanced by decreasing the overall volume of water flowing through it. This can best be accomplished by reducing the volume of water flowing out of the Base's developed areas.

The concept of infiltrating stormwater into the ground, close to where it is created, should be incorporated in all projects. Adopting this strategy can lower infrastructure construction costs, as well as long-term maintenance expenses. The Base's relatively flat topography creates abundant opportunities to incorporate sustainable site techniques, such as bioretention gardens, rain gardens, bioswales and rapid infiltration trenches, into new construction projects. These make excellent places to plant species that require more water. Water infiltrated into these areas will also benefit local groundwater conditions, potentially providing water to deeply-rooted trees that are nearby. The Base's soils have an ability to hold water, although the rate of water uptake, or permeability, is slow. This condition will need to be taken into consideration when these features are designed. The use of amended soil mixes with bioretention gardens and bioswales can improve initial rates of infiltration, improving the functioning and long-term success of these features.

Linear bioretention gardens could be developed along existing roadways to improve local infiltration and enhance the visual character along these roads. These gardens could be long and fairly narrow. It would be important to select plants that can withstand the reflected heat from the adjacent pavement. Typically, native plants perform best in this situation. It would be prudent to design and install a few of these gardens in select locations and monitor their performance for two to three years before undertaking a large scale installation of them *(see Figure 5.2)*.

Along open drainage ditches, "off-line" infiltration areas can be developed. These are areas adjacent to, but out of the direct flow of, the ditch. After a storm, as stormwater flows through the ditch, some of its water would run into these "backwater" areas, allowing it to infiltrate into the ground. These can be designed to decrease or eliminate flows during smaller-sized storms, which typically comprise the majority of rainstorms.

Rainwater harvested from building roofs and paved areas should be directed to rain gardens or shallow depressions in lawn areas that are at least 10-feet away from buildings or paved areas, to avoid problems with site soils having high shrink-swell potential. Further study will be needed to determine a safe distance that a rain garden, bioretention cell, or other infiltration structure should be located from any structure or pavements.

Sustainability Recommendations

The recommendations described below are derived from the specific information obtained from the Ellsworth AFB Installation Sustainability Assessment (ISA). They are intended for further definition, and to assist in the development of projects that would have a direct and viable impact on the sustainability of the Installation.

- *Develop strategies to decrease the commuting carbon footprint by encouraging carpooling, public transportation, and high efficiency/non carbon-based fuel vehicles.*

- *Continue to improve on energy efficiency by using fuels such as natural gas to reduce total carbon-based fuel consumed. This can be accomplished by assessing existing building systems via the retro-commissioning process and by improving existing systems.*

- *Complete sub-metering in order to capture and analyze the data to facilitate focused direction on future projects that will impact energy usage, carbon footprint, water conservation, etc.*

- *Continue to reduce small appliance duplication, replace low efficiency motors, and change light fixture types at buildings. These efforts should be analyzed on a building by building basis to establish the return on investment.*

- *Continue to implement the required 2% reduction per year of water consumption based on the Executive Order through the following:*

    - *Implement the next generation of low flush toilets and urinals, and introduce automatic faucets on hand wash sinks.*
    - *Reduce the amount of water used for irrigation on Base by using more native plant species that are able to survive with little to no irrigation.*

- *Incorporate composting practices with a garbage hauler in lieu of sending waste to the landfill.*

- *Remove or schedule for reuse all unused or undesirable buildings to bring the square feet per FTE closer to the benchmark average.*

- *Future development of the Installation should consider improving the overall density of the Base, and providing proximity to supporting services.*

- *Conduct a study to determine existing internal traffic counts and internal commuting to examine the impact of the proximity of services on energy usage and carbon footprint.*

- *Remove unused or excessive areas of pavement to reduce heat island effects and to decrease the total volume of stormwater created on Base.*

- *Incorporate pervious concrete pavements in parking areas and sidewalks, and add green space islands within parking lots at Ellsworth AFB.*

- *Reduce site lighting and air field lighting to minimum requirements.*

- *Analyze if existing parking can be "shared" with new facilities on all new and remodel construction projects. Build the minimum amount of parking if new parking is needed.*

- *Remove unused or excessive areas of pavement and roads, to reduce heat island effects and to decrease the total volume of stormwater created on Base.*

- *Add tree islands within existing and proposed parking lots at Ellsworth AFB.*

[5.2] Site Development

Site development at Ellsworth AFB should incorporate both traditional standards of good site planning and emerging technologies of sustainable design. These design philosophies have much in common – a high level of functionality, thoughtful use of land, and careful use of natural resources. Adding "green design" to good site design will only improve how a site functions.

One important factor in green design is that stormwater is viewed as a resource to be utilized rather than a nuisance to be quickly conveyed and disposed of elsewhere. This change in viewpoint has vast implications on site design and development. These are discussed in this section and the preceding section.

Parking

Avoid Over-Development

When constructing new facilities or renovating existing facilities, a review of existing available parking should be conducted to determine if some or all of the required new parking can be provided by using existing parking lots *(see Figure 5.3)*. Shared parking between two or more facilities might be possible.

Figure 5.3
Use of Existing Parking Lots

The most sustainable parking stall is one that is used on a daily basis. When determining the number of parking stalls for projects, follow the guidance in Air Force Handbook (AFH) 32-1084. Avoid over-sizing parking lots. Seldom-used parking stalls consume land, require expensive periodic maintenance, contribute to the heat island effect, and generate stormwater runoff. Include compact-size vehicle stalls in all new parking lot designs and when restriping existing parking areas.

- *Analyze parking needed thoroughly for new and existing facilities*
- *Consider feasibility of shared-use parking lots*
- *Establish number of parking lot stalls for projects using AFH 32-1084*
- *Avoid constructing seldom-used parking stalls*
- *Include compact-size vehicle stalls in all parking lots*
- *Allocate 5% of stalls for car/vanpools*
- *Allocate 5% of stalls for low-emitting vehicles*

Green vs. Piped Systems

Keeping stormwater on the surface until it can be routed to infiltration areas or allowed to percolate into permeable or porous pavements is more sustainable than traditional piped storm sewer systems. Green solutions, such as the use of rain gardens or bioretention gardens, address stormwater quality and quantity issues. Research has shown that green solutions can provide cost savings over piped solutions. Regulatory testing of water cleansed using green solutions is often less rigorous or not required when compared to piped systems.

Including bioretention features within parking lots provides several benefits. Stormwater is intercepted and cleansed near to where it falls. Plantings in these gardens break-up the massive expanse of larger parking lots, and mitigate the heat island effect created by pavement, providing shade for vehicles and pedestrians walking to their cars *(see Figure 5.4)*.

Figure 5.4
Provide Shading along Pavement

- *Infiltrate stormwater into the ground near where it's created*
- *Use stormwater as a resource instead of viewing it as an expensive nuisance*
- *Avoid piped solutions except in intensely developed areas*
- *Incorporate green solutions (bioretention gardens, bioswales, rain gardens, etc.) in parking lot designs, to provide multiple benefits*
- *Monitor projects on Base to determine which types of features perform best at Ellsworth AFB*

Permeable and Porous Pavements

Innovative pavement systems which allow stormwater to drain through them are becoming more common (*see Figure 5.5)*. Testing in New Hampshire has demonstrated that snow on permeable asphalt melts faster, with no ice accumulation. Porous concrete infiltrates snow melt water without damage.

Figure 5.5
Pervious Paver System

A key factor of success in using these materials is rapidly draining the soils under them. Soils at Ellsworth AFB have slow permeability and high shrink-swell potential. Due to these characteristics, infiltrating water directly into the subgrade below pavement is not desirable from an engineering standpoint. The use of permeable and porous pavements at Ellsworth AFB could be used at locations where it is desirable to temporarily detain water in the rock sub-base below the pavement. A waterproof liner would be needed to isolate the rock sub-base and any stormwater from the subgrade below it. The water would slowly be released after a storm.

The delayed release could be used to lower the peak rate of water leaving a site or to provide water to a rain garden or bioretention cell whose plants could use it for evapotranspiration. Use of permeable and porous pavements should be considered when site size constraints prevent using green infrastructure to accomplish the same goals. Porous concrete is not appropriate for areas used by heavy vehicles or in truck loading areas, where trucks turn on a continuous basis. It is appropriate for most privately-owned vehicles or small government-owned vehicle parking areas, which constitute a large portion of pavement on most Bases.

In every situation, site designers should design pavement areas to meet functional needs with the minimum amount of pavement necessary. This lowers construction costs, lowers long-term maintenance expenses, and decreases the amount of storm water generated, thereby creating a triple bottom-line benefit for the Base.

- *Limit the extent of pavement to the least amount required to meet functional needs*
- *Consider use of permeable or porous pavements where traffic loads permit*
- *Benefits from using permeable or porous pavements at Ellsworth AFB would primarily be to lower storm flow peaks*
- *Monitor the performance of previous and permeable pavements installed at Ellsworth AFB to determine their performance and develop a "lessons learned" document to guide future design of similar pavements*

Green Infrastructure in Parking Lots

New and reconstructed existing parking lots should incorporate green infrastructure concepts. Due to the limited amount of precipitation received at Ellsworth AFB, bioswales or bioretention gardens planted with native plants should be used to capture, cleanse, and infiltrate runoff. Shade trees could be planted within the bioswales to shade vehicles and pavement. A continuous bioswale, approximately twenty feet wide, should be placed every two bays of parking in large lots. Pavement should be sloped to drain to the bioswales. Along the pavement edge, a flush band of crushed rock should be placed to collect debris and petroleum in the first flush of run-off. Vehicle wheel barriers would be placed along the pavement edge to allow un-concentrated sheet flow into the bioswales.

In parking lots less than two parking bays wide, or where a continuous bioswale island isn't possible, bioswale openings can be designed into the pavement areas. These non-paved areas should be the same size as four standard parking stalls, to provide adequate area for shade trees. Pavement surfaces would slope to these openings, demarcated with vehicle wheel stops. Native grasses, shrubs and well-adapted shade trees could be planted in the openings to cleanse runoff *(see Figure 5.6)*.

In the Airmen's Dormitory area, the current number of parking stalls greatly exceeds parking demand, due to the conversion of two-person rooms to single-person suites. Large areas of parking could be removed to bring the parking supply back into balance with the parking demand. Green infrastructure solutions should be designed into these parking lot reconstruction projects. The elimination of excess pavement will lower the volume of run-off from the lots and allow some of the stormwater to be cleansed and infiltrated on-site *(see Figure 5.7)*.

Soils in the rain gardens, bioretention cells, and bioswales should be amended to be equal portions by volume of sand and compost. This soil mixture will allow rapid infiltration of stormwater, while retaining moisture to support plant growth during dry periods. Deep-rooted plants increase the infiltration rate of these bioswales, gardens, and cells over time, improving their performance. The organic matter in the compost will serve as a filter and remove or retain certain contaminates. Research in Minnesota has proven that bioswales, gardens and cells function year-round, providing stormwater management benefits in all seasons.

In some locations the use of green infrastructure may not be possible due to space constraints. In those cases, structural, non-biologic Best Management

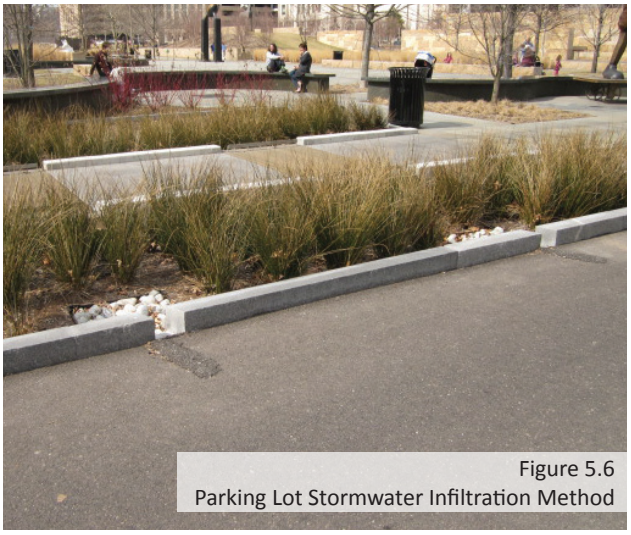


Figure 5.6
Parking Lot Stormwater Infiltration Method

Practices (BMPs) should be incorporated into the design. Structural BMPs include hydrodynamic separators which remove debris and sediment from stormwater, and underground storage systems to detain stormwater for later release. While these structures provide similar benefits to green infrastructure, they have a higher initial construction cost and may require frequent maintenance.

- *Manage stormwater within the footprint of parking lots where possible*
- *Properly prepare soils in bioswales and retention gardens to ensure long term success*
- *Use deeply-rooted native plant species in plantings to improve infiltration over time*
- *Include green solutions in parking lot reconstructions as well as new construction*
- *Incorporate structural BMPs into projects when space constraints prevent the use of green infrastructure*
- *Create a lessons learned document of green infrastructure/ structural BMPs for Ellsworth AFB*

Figure 5.7
Oversized Parking Lots Increase Stormwater Runoff

Rainwater Harvest Systems
Collection of rain and snow-melt water from building roofs for use as greywater for supplemental irrigation on high-visibility landscape areas should be considered in future construction projects. These systems require careful design and adherence to current building codes. Their primary benefit is that they make water which could be viewed as a liability into a useable asset.

Access and Accessibility
Vehicle access to a new or redevelopment site should use best practices relative to traffic flow and distance of site entry and exit points to existing road intersections. The relatively flat topography at Ellsworth AFB allows site accessibility requirements to be easily met.

When a POV parking lot with accessible parking stalls is separated from the facility it serves by a street, a clearly-marked pedestrian crossing should be established to provide a reasonably direct travel route for persons using the lot.

- *Locate POV parking near new facilities when possible*
- *Provide clearly-marked pedestrian crossings when remote parking is required*

Open Space and Recreation

Several recommendations regarding open space and recreational facilities have been made in previous Sections of the ID2. An overriding consideration in the development of new open spaces or the renovation of existing open spaces should be to focus on a level of quality that can be sustained at Ellsworth AFB. Wind, sun, and temperature extremes during the year provide clues on what features are needed for successful site development at the Base. Wind protection in the form of plantings and structures can provide relief from hot summer winds, as well as the chill of bitter winter winds. Shade structures and overhead canopies of trees provide shelter from hot and intense sunlight.

To improve environmental conditions near the various sport fields, shade trees should be added to provide shade for spectators and participants, shade parking areas, and help define spaces surrounding the fields. Creating an urban forest on Ellsworth AFB will provide green infrastructure benefits of reduced heat island effect, reduced stormwater runoff volume, and improved microclimate to encourage active lifestyles. Certain areas of the Base are not good candidates for development of an urban forest, including the airfield and portions of the Base's industrial areas.

- *Create sustainable outdoor areas at Ellsworth AFB that include features that buffer winds and provide shade*
- *Provide shade by creating an urban forest on Base to increase use of sidewalks, trails, and outdoor recreations areas*
- *Provide shade trees at all sports fields to shade spectators and buffer wind*

Landscape Plantings

To survive at Ellsworth AFB, landscape plant selections for community open spaces must take into consideration the area's harsh environmental conditions, and regionally native or well-adapted plant species should be used. Clustering plantings to create plants in close association will be more successful in this setting than attempting to create a landscape of specimen plants. Determining the irrigation requirements for the proposed plantings and then confirming that an adequate supply of water is available for the plantings is the final step in the design process *(see Figure 5.8)*.

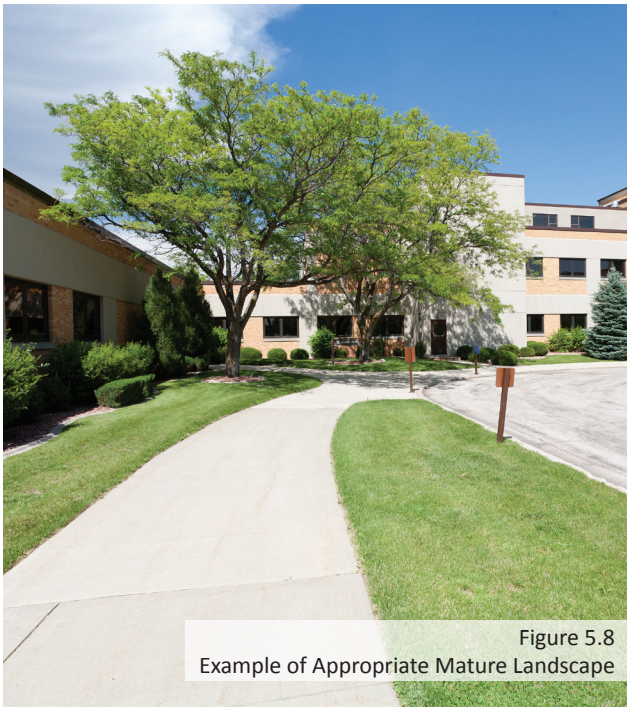


Figure 5.8
Example of Appropriate Mature Landscape

Long-term success for landscape plantings is directly tied to proper site preparation. Inadequate site preparation will result in landscape plantings that will never reach their potential, and in many cases do not reach maturity. Depending upon soil conditions, this may entail little more than correctly digging the planting hole and carefully backfilling soil around the plant roots. In other cases, it may require a complete removal and replacement of existing site soils with prepared soils to improve drainage or provide a more conducive environment for plant roots. Correcting compacted soil conditions is necessary on most construction sites.

A chronic problem occurring with landscape planting across Ellsworth AFB is improper pruning as part of on-going landscape maintenance. Plant spacing in projects should be based on the plant's ultimate size and the designer's intent. Many shrubs are trimmed into a sphere or upright cube which greatly reduces their natural ability to mature. Pruning should be used to enhance the natural form of shrubs or to elevate the height of lower branches on young trees. To alleviate the issue of improper planting, the landscape architect on each project should be required to provide a sketch showing the mature plant size and form relative to the building façade. This drawing would help Base Civil Engineering confirm that the size of mature plantings match the architecture and fit within the available space. While this drawing will not prevent improper pruning, it would convey design intent and set a standard to be followed relative to pruning. This would also lower landscape maintenance costs over the long-term, improving the financial sustainability of maintaining an attractive and healthy Base landscape.

- *Use native or well-adapted plant species*
- *Cluster plantings to create natural-like communities of plants*
- *Prepare sites correctly prior to plantings*
- *Match planting space to mature plant size*
- *Require landscape architects to provide elevations showing desired mature plant sizes and forms to guide landscape management efforts*

[5.3] Architectural Design

Ellsworth AFB is located in the high plains of South Dakota, approximately 10 miles east of Rapid City. The Base's population includes approximately 8,000 military members, their families, and civilian personnel. Rapid City has a population of just over 62,500, and there are about 3,800 military retirees in western South Dakota.

Many scenic sights surround Ellsworth AFB. From the majestic Badlands to the east, to the Black Hills in the west, and the grazing buffalo and mirror-image lakes in Custer State Park, this is a region of great natural beauty.

Rapid City has a distinct local design character in the downtown area, with a fairly large and intact main street built around the turn of the last century. This style of architecture consists of a two-story face brick street façades, usually with ornate pediments or cornices. The first floors incorporate large storefront windows, while the second floors typically have tall double-hung windows. Whereas this style of architecture creates the image of an historic downtown for Rapid City, its translation to an Air Force Base is not particularly appropriate.

Ellsworth AFB has seen sporadic building campaigns over several decades since its inception during World War II. This has led to a mix of architectural styles on the Base, which tends to produce a disjointed and vague architectural identity. If anything, a "prairie style" pervades some of the newer facilities on Base, perhaps owing to the sloped roofs and deep overhangs. However, no one particular style could ever hope to accommodate all the different types of facilities required on a modern Air Force Base.

In an attempt to create a unified Base identity, the following recommendations should be considered for all new construction and renovation work at the Base. These recommendations incorporate the good design practices already in use on the Base, while at the same time affording the designer the latitude to explore new and unique solutions to the specific design issues at hand. At all times, sustainable design and high-performance green building principles should inform the design decisions regarding a specific project.

The following goals should guide all levels of design at Ellsworth AFB:

- *Low Maintenance: Use permanent low maintenance exterior materials that are complementary to the natural and man-made environment (see Figure 5.9).*
- *Environmental: Design facilities in ways to enhance environmental quality and minimize consumption of natural resources.*
- *Layouts: Provide functional layouts that satisfy user needs.*
- *Cost: Reduce life cycle costs.*
- *Labor: Reduce labor-intensive maintenance procedures.*

Figure 5.9
37th B-1 Squad Operations - Low Maintenance Exterior Materials

Figure 5.10
Commissary: Community Zone

Building Zones

Ellsworth AFB is divided into four (4) Zones: Residential; Community; Flight Line; and Ordnance. The segregation between zones is fairly evident, except between the Community and Flight Line Zones, whose borders tend to blur. The architecture in each zone needs to respond to the unique requirements of the facilities located within it, as well as the overall context of the Base. Building forms, massing, scale, and siting will vary from zone to zone, while still maintaining an overall sense of cohesiveness within the Base through the use of materials and detailing.

Zone 1, Residential Zone
The Residential Zone incorporates single-family housing on the Base, along with the Child Development Center and the Visiting Officers Quarters. The Base has recently replaced a large portion of its housing, which allowed the demolition of an equal number of housing units directly north of the Community Zone. This vacant land provides infill opportunities for the Base, of either a residential or community nature.

A large housing area on the northern portion of the Residential Zone is under a long-term lease agreement with a private developer. The lease period is set to expire, and at this time, the Base does not intend to extend the lease, which will mean that these houses will be available to the open market. Military personnel will be given preference in leasing these houses, and owing to the area's remoteness from Rapid City, Base personnel would be the most logical target market for the developer.

The Residential Zone is separated geographically from the remainder of the Base, which would allow housing privatization to occur with little impact to the Base. Since single-family housing may be privatized in the future, it is therefore excluded from consideration in the Installation Development and Design (ID2) Handbook.

Zone 2, Community Zone
The Community Zone includes the dormitories, dining hall, library, theater, bowling alley, bank, exchange, commissary, fitness center, youth center, medical clinic, convenience store, chapels, and Rushmore Center, which function together as the "town center" for the Base. Other buildings in this zone include the Security Forces facility, and AF Financial Services Center facilities. The function of the AF Financial Services Center facilities, being primarily administrative, complements the uses of the Community Zone, whereas the Security Forces facility seems incongruous to this area.

The majority of the facilities in this zone were constructed 20- to 40-years ago, with the exceptions being the Rushmore Center and AF Financial Services Center facilities, which are less than 20-years old. The facilities in this zone appear fairly untouched from their original appearance, with little evidence of renovation or alteration. However, the facilities appear to be well maintained and in good repair. The architectural styles of the various facilities in this zone vary more than the other two zones, with individual facilities reflecting the prevailing trends of their eras (*see Figure 5.10)*.

Zone 3, Flight Line Zone
The Flight Line Zone contains the majority of facilities on Base. These include the hangars, Base communications, Wing Headquarters, flight line support and maintenance, training, and civil engineering facilities. This zone has the greatest age variance on Base, with historical structures

Figure 5.11
Base Operations Facility: Flight Line Zone

such as the Pride Hangar and Propulsion Shop, and more recently completed facilities such as the Base Engineering Administration and Base Operations facilities (*see Figure 5.11)*.

This zone is by far the most spread-out and unconnected zone on Base, with many facilities hugging the runway because of their use, and other facilities seeming to have little relationship to the overall function of the zone, such as the Wing Headquarters and Airmen's Leadership School. Facilities in this zone would benefit from a greater connection to each other, as well as a more simplified and logical street system.

Zone 4, Ordnance Zone

The Ordnance Zone comprises ordnance storage and handling facilities on Base (*see Figure 5.12)*. Because of its use, this zone is remotely located from the other zones on Base, and its facilities are very utilitarian in nature. The Ordnance Zone is excluded from consideration in this Installation Development and Design (ID2) Handbook.

Figure 5.12
Typical Ordnance Bunker

Architectural Order

Plan Complexity and Geometry

Typically, the older facilities at Ellsworth AFB are fairly simple in plan and geometry. This is a function of the utilitarian uses of most of these buildings, such as the hangars. Newer facilities utilize a more complicated plan and geometry, based on one of two design concepts. Some facilities, such as the Rushmore Center and AF Financial Services Center, pay homage to the "prairie style" of architecture, with narrow floor plates, multiple building wings, and sloped roofs. Other facilities, such as the Wing Headquarters, 34th and 37th Squadron Operations facilities, and Maintenance Group Headquarters incorporate complex plans, building massing, and roof geometries. The newer facilities tend to focus on high quality architectural design, without an over-riding style or form.

If anything, the newer facilities at Ellsworth AFB can stand alone as good design in and of themselves, but this can produce buildings that do not relate contextually to one another. A notable exception to this situation is the complex comprising the 34th Squadron Operations facility, the 37th Squadron Operations facility, and the Maintenance Group Headquarters. These facilities respect the context of the adjacent Base environment, while at the same time producing unique and quality architecture.

Future construction projects should attempt to continue this articulation of the building footprint, which will serve a number of functions: to allow more daylight and views into the occupied portions of the building; to create sheltered exterior plazas and courtyards; and to create functionally responsive plans to the programmatic requirements of the facility. Whereas each of the aforementioned concepts might be achieved with a simple square

plan, a square or rectilinear plan should not be the default design solution.

When designing a new facility, consideration should also be given to future additions to the facility. Oftentimes, a more complex plan geometry lends itself better to future additions than a more formal geometry.

- *Incorporate daylight into facility interiors*
- *Use floor plan articulation to create exterior courtyards and plazas*
- *Consider future additions*

Figure 5.13
Base Operations Facility: Two Story Entry Atrium

Building Scale and Proportion

The building scale of the existing facilities at Ellsworth AFB mostly conforms to the programmatic requirements of the facility. For example, a hangar is sized to accommodate the aircraft to be housed there. This concept of scaling facilities to meet their programmatic requirements should be continued in future building projects.

A few exceptions to the concept of scale matching function occur on Base. For example, the Base Operations facility incorporates a large two-story central area, which serves to bring daylight into the interior and to designate the importance of this facility as the front door to the Base from the flight line (*see Figure 5.13)*. The 34th and 37th Squadron Operations facilities, and the Maintenance Group Headquarters, incorporate large broken roof planes, which allow clerestory glazing to flood the interior corridors with daylight (*see Figure 5.14)*. And the Wing Headquarters and adjacent 28th Squadron Operations facilities utilize soaring roof slopes and insulating translucent panel skylights, to reinforce the importance of these facilities in regard to the Base's mission.

Most facilities on Base are one-story buildings, owing to the relative abundance of land, with a few broken-up by split-levels to address the Base's terrain. Newer facilities tend to be multi-story, which allows narrower floor plates to bring more daylight into the building interiors.

Even though land is readily available, future facilities should continue this trend of multi-story solutions. Multi-story solutions may more appropriately address a facility's programmatic requirements by facilitating adjacencies, as well as presenting more

Figure 5.14
37th Squadron Operations Facility:
Large Broken Roof Planes Reduces Scale of Building

opportunities for daylight and views. Furthermore, facilities located near the flight line may benefit from the larger massing of a multi-story solution, in relationship to the large adjacent hangars. Of course, costs must be weighed in any design solution, but the additional costs of stairs and elevators in a multi-story facility may be offset by the reduced amount of exterior skin. A multi-story solution also allows narrower floor plates, which are more suited to a sloped roof. Finally, multi-story solutions will allow the Base to increase development densities, while at the same time maintaining open space and the associated benefits for Base personnel and storm water management.

- *Consider multi-story solutions to address programmatic requirements with small site impact*
- *Scale new facilities to relate to adjacent context*
- *Incorporated thoughtful roof designs to increase daylight into the interior*

Figure 5.15
Civil Engineering Administration Facility:
Low Profile with Roof Overhangs to Shade Windows

Massing and Typical Bay Spacing

Building massing at Ellsworth AFB tends to reflect the age of the facility. The older facilities are sized to accommodate the function inside. An obvious example of this is the Pride Hangar, a historic structure built to accommodate the B-36. Newer facilities on Base utilize massing in either a more traditional manner or a more modern manner, with the latter being incorporated into complex plans and geometries to differentiate the functions inside.

Care should be taken to assure the appropriate roof type is chosen for the facility, as this will impact the building's massing more than any other single element (*see Figure 5.15)*. Very large facilities, such as hangars, the Exchange, and Commissary, should utilize low-slope roofs. Smaller facilities, especially those with narrow floor plates and simple geometries, could utilize a standing seam metal roof to complement other such roofs on Base. The desired roof type of the building must be considered when designing a facility, and should be reflected in the solution's plan, both from a scale and constructability standpoint. A very geometrically complicated plan is difficult to cap with a sloped roof. Ultimately, the roofing solution will be an outcome of the development process, and should not be determined beforehand. A standing seam metal roof may be an appropriate solution for some facilities, as long as its use does not preclude achieving other sustainable design and high performance green building requirements (*see Figure 5.16)*.

Figure 5.16
Fire/Crash Rescue Facility:
Bay Spacing and Use of Low Sloping Standing Seam Metal Roofing

Examples of buildings which use sloped standing seam metal roofing are plentiful on the Base. Notable buildings that have used this roofing technique most successfully are the Base Operations facility, the 34th Squadron Operations facility, and the 37th Squadron Operations facility, which allow the interior spaces to contain elevated ceiling heights and also utilize daylighting techniques that are designed into the roof shapes.

Because most facilities on Base are designed to house the specific function of the facility, bay spacing is not an apparent design issue. Whereas the Base has many hangar and ordnance facilities, these are typically the only replicated building type, and other buildings are designed for their own specific use. This concept should be continued in future building projects, in that the buildings should reflect their individual programmatic requirements, and not some arbitrarily selected bay spacing or massing. However, both massing and bay spacing of a new facility should take into account adjacent facilities, in order to create a complementary design.

- *Select roofing design and materials to complement facility size and type*
- *Use building massing and bay spacing to address programmatic requirements and surrounding context*

Siting and Orientation

The typical facility located in the Flight Line zone of Ellsworth AFB either aligns with the current runway, set approximately 45-degrees from orthogonal, or the old abandoned runway, which ran north-south. The facilities in the Community zone either align with the orthogonal street grid, or are set skewed on the site. And the facilities in the Residential zone follow the irregular street pattern. Whereas aligning the facilities in the Flight Line Zone with the runway makes functional sense, for other facilities an orientation closer to the ordinal directions may be more beneficial from a solar perspective.

When siting future facilities to be built on Base, sustainable design and high-performance green building principles need to be taken into consideration. HQ ACC had emphasized the importance of daylight and views within their facilities, as well as the performance of the exterior building envelope in regard to energy use reduction. Careful analysis of each facility needs to be conducted during the concept development process to verify the most beneficial orientation of the building, regardless of alignment with adjacent facilities. Sun control devices should be incorporated into the design as appropriate, and as required to mitigate solar heat gain for those facilities that cannot be optimally oriented. Furthermore, the direction of the prevailing winds should inform the design of facilities, with main entrances, courtyards, and exterior plazas being sheltered from these ever-present winds.

Efficient land use is another factor to consider when siting buildings, along with the requisite guidance relative to Anti-Terrorism/Force Protection (*see Figure 5.17)*. On this Base, there is abundant land mass and plentiful infill opportunities that make these factors easier to deal with. It is important to keep in mind that future buildings may share the standoff distances created between buildings, which will allow better utilization of the land and infrastructure of the Base.

- *Orient facilities to take advantage of sun angles and prevailing winds*
- *Incorporate sun control devices to address glare and solar heat gain*
- *Site facilities to maximize land use, while still complying with AT/FP requirements*

Figure 5.17
Maintenance Group Headquarters: AT/FP Barrier

Symmetry and Hierarchy of Elevations

Ellsworth AFB has few historical buildings, and as such, the concept of symmetry is not prevalent on Base. Building design has tended to reflect the prevailing trends when the facilities were constructed, with symmetry being a minor consideration. A more prevalent design concept on Base is the modern credo of "Form follows Function", with the building massing and fenestration reflecting the interior uses. A positive design concept common to the newer facilities on Base is the use of long, linear floor plates, which allow for greater access to daylight and views within the facility. A perfect example of this concept, which also happens to be one of the few facilities to incorporate symmetry, is the AF Financial Services Center. The symmetry and long floor plates have the added bonus of creating a courtyard enclosed on three sides *(see Figure 5.18)*.

Existing facilities on Base tend to treat all elevations equally, with little difference in design articulation between the facades. This design concept serves the Base well, since most facilities are separated from their neighbors, and all sides are usually visible from surrounding roadways. The facilities which articulate all facades in a more equal fashion create a more human scale on all sides of the building.

An exception to this consistent articulation is the hangars, with their large doors facing the runway, and little if any articulation of the remaining sides of the building, as well as some of the more industrial buildings along the perimeter of the Flight Line Zone. Unfortunately, these buildings are visible from the Residential and Community zones, and oftentimes the backs of these buildings are facing these other zones.

Figure 5.19
Large Open Green Space Adjacent to Facility

Future construction and renovation efforts on Base should continue this trend of articulating all building facades that are accessible or visible to Base personnel. At all times, the main entry to the facility needs to be maintained as the primary focus of the exterior elevations, in order to enhance wayfinding on the Base. There are many good examples of architectural solutions on this Base that enhance building entrance identification, such as the Base Operations facility, Weapon Systems Trainer facility, and 37th Squadron Operations facility.

- *Articulate all building facades visible to Base personnel*
- *Emphasize building entry*

Open Spaces

Ellsworth AFB has a surplus of open space located on Base, but this open space is not necessarily being used as a benefit. Buildings tend to be sited in the middle of a parcel of land surrounded by parking and open space, and few facilities have a relationship to each other. Furthermore, the area experiences continual wind at many times during the year, making unprotected open space unpleasant (*see Figure 5.19)*.

Figure 5.18
AF Financial Services Center: Courtyard

Figure 5.20
Child Development Center: Covered Outdoor Colonnade

The major open space on Base is the series of lakes and drainageway separating the Flight Line Zone from the Community zone. Whereas this central park area is a great asset to the Base, integrating it into the overall fabric of the Base has not been very successful. Additional pedestrian ways and destination points need to be incorporated into this area to realize its full potential for the Base.

A notable example of a complex of buildings with a positive relationship to each other is the 34th Squadron Operations facility, 37th Squadron Operations facility, and Maintenance Group Headquarters. These buildings appear to share some parking facilities, and the design of the buildings themselves, along with their site design, creates synergy and sense of place. And owing to the buildings' close proximity to one another, a more pedestrian friendly environment is created. This "urban" environment would be enhanced more with the addition of covered exterior plazas or site amenities to reinforce the pedestrian feel of the area.

There are few examples of good exterior plazas on Base, but some facilities have incorporated courtyards to great success. These courtyards are usually a function of the design of a single building, in lieu of the result of grouping several buildings together. Two notable courtyards are at the Rushmore Center and the AF Financial Services Center. These courtyards could be improved with the addition of covered porticos or canopies to further define these exterior rooms. The benefit of courtyards in this region is the shelter they provide from the ever-present winds (*see Figure 5.20)*.

The airmen's dormitories complex has the potential to create a positive courtyard between the various buildings, but this area is currently under-utilized and poorly designed. The area between the buildings is fairly large, and would benefit from being broken into smaller components through the use of landscaping and covered structures. An added benefit of creating more definable spaces within the courtyard is that these areas will be adopted by the adjacent dormitory residents, providing a sense of security and pride of ownership.

Future construction and renovation efforts on Base should focus on the exterior spaces around the buildings, as well as the spaces between buildings. There is opportunity to create a sense of community by siting adjacent buildings to take advantage of the exterior space between them, as well as to create areas to concentrate landscaping. By concentrating landscaping in certain areas on Base that relate to the buildings, pleasant exterior environments can be created for the enjoyment of Base personnel, and the landscaping is easier to maintain. Furthermore, these oases can counteract the perception of the sparsely vegetated landscape of this region.

- *Create exterior environments, such as courtyards or plazas*
- *Concentrate landscaping in specific areas most accessible to Base personnel*

Architectural Elements

Materials

Exterior building materials should be chosen for their durability, color and appearance retention, and ease of maintenance. Furthermore, materials should be chosen to support the sustainable design principles of regional materials and recycled content.

The predominant exterior building materials on Base are reddish-brown face brick and concrete masonry units in a medium tan to limestone color. The older buildings on Base, those built between 20- and 40-years ago, typically are all face brick, whereas the

Figure 5.21
Typical Materials: Community Zone

newer buildings, built in the last 20-years, oftentimes use a combination of face brick and concrete masonry units. These materials can be used in a more traditional manner, with the CMU used as a wainscot and/or as banding within the brick façade, or in a more modern manner, with different building masses being clad in one or the other material (*see Figure 5.21)*. Architectural precast concrete in a limestone color is often used for window sills and accent banding.

An interesting and successful example of the long term durability and flexibility of a masonry exterior is seen in the AF Financial Services Center Administration facility. This building was renovated to meet this new mission assigned to Ellsworth AFB. The face brick exterior looked dated, and the various additions and renovations throughout the life of the facility had created a patchwork of different bricks. The Base chose to stain the existing face brick in order to create a consistent exterior appearance, which created the look of a new building. The staining process was relatively economical, and carries an extended warranty (*see Figure 5.22)*.

Prefinished metal wall panels and composite metal building panels are utilized on larger buildings, such as the hangars and squadron operations facilities. In the more architectural buildings, these panels are typically used in a modern fashion, as cladding for building masses and distinct elements (*see Figure 5.23)*. Standing seam metal roofs in dark brown to medium gray color are utilized on a number of facilities, and will be addressed later in this section.

Exterior materials for new facilities should be selected to complement the overall aesthetic of the Base. Masonry in medium tan to reddish-brown colors, incorporating details and banding in complimentary materials, is recommended (*see Figure 5.24)*. There are many examples at this Base of innovative designs

Figure 5.22
AF Financial Services Administration Facility: Stained Brick

that incorporate more than one masonry material on the building exterior, such as the Rushmore Center with its wainscot and banding; the Fire Station with its horizontal banding and a more varied face brick blend; and the Maintenance Group Headquarters, with its large masses of different masonry materials.

Metal wall panels and composite metal building panels may be used as appropriate for the facility's function and scale, but should be protected from abuse at the building base and openings. Other

Figure 5.23
Typical Materials: Flight Line/Mission Zone

Figure 5.24
Typical Materials: Flight Line/Mission Zone

exterior materials, such as cement board siding, may be considered as appropriate to the building's architectural design. Exterior insulation finish systems (E.I.F.S.), due to their poor performance history (Ellsworth AFB has had some failures) and due to lack of a comprehensive manufacturer's warranty, are prohibited by HQ ACC, and may not be used at Ellsworth AFB.

- *Use masonry colors that complement other facilities on Base*
- *Incorporate horizontal masonry banding and details*

Fenestration

Building fenestration should be designed to enhance the exterior image of facilities, as well as to incorporate daylight and views into the building interior. Primary concerns regarding building fenestration should be its effect on the building envelope performance, as well as compliance with Anti-Terrorism/Force Protection requirements.

In the design of new facilities, prominence of the building's main entrance must be achieved. The main entrance must be welcoming, sheltered, and visible to the building's occupants to enhance security (*see Figure 5.25)*.

Glazed aluminum swinging doors are the standard on Base, oftentimes with surrounding sidelites and transoms. This type of entrance should be continued with future building projects. All building entrances must be handicap accessible.

The majority of buildings on Base utilize thermally-broken aluminum frame windows, with high-performance glazing. Most newer commercial buildings on Base utilize fixed windows, with operable windows more typically found in the older buildings and dormitories. However, operable windows are encouraged where appropriate for future facility design, in order to enhance the indoor air quality of the facility, and to give the building's occupants greater personal control over their thermal environment. Operable windows are especially appropriate at Ellsworth AFB, because of the relatively cool temperatures and low humidity of the region.

The type of glazing selected for exterior windows and doors should be carefully analyzed in regard to thermal performance, and its effect on the overall building envelope. Whereas bronze- and gray-tinted glazing is predominant on Base, other glazing tints may be considered as appropriate to the individual project. Additional glazing coatings, beyond the standard Lo-E coating, should be considered to

Figure 5.25
Base Civil Engineering Admin. Facility: Entry Fenestration

improve glazing performance, as well as the inclusion of various gases in the interstitial space in insulating glass units. Glazing tint should be analyzed regarding visible light transmittance, in order to maximize the amount of controlled daylighting entering the facility. Finally, all exterior glazing must comply with Anti-Terrorism/Force Protection requirements (*see Figure 5.26)*.

Facilities on Base utilize a wide range of aluminum finishes, from dark bronze to clear anodized. Aluminum finishes should be selected as appropriate to the overall aesthetic of new facilities, and as a complement to the glazing tint. Dark bronze or black anodized frames are discouraged for future projects, since research has shown that dark window frames increase interior glare.

Daylight and views must be analyzed when designing the fenestration of a new facility. Meeting HQ ACC's requirements for daylight and views may require a much greater amount of glazing than is found in the typical building on Base, and these requirements may inform the design of the building footprint as well. Long, linear buildings, as well as multi-story facilities, have greater opportunities for introducing daylight and views into the building interior, and these concepts should be considered in the initial concept development phase of a project.

Sun control at exterior windows may be required for enhancing the interior environment of a facility. Glare at work surface level should be avoided, which may require the inclusion of exterior sun shading devices at the windows, sun control films incorporated into the insulating glass units, or deep roof overhangs. Light shelves installed on the interior of clerestory glazing can bring sunlight further into the interior of the building, and should be considered. In all, a combination of vision glazing and clerestory glazing should be considered to maximize daylight and views within the facility, while at the same time controlling unwanted glare and heat gain.

Figure 5.26
37th Squadron Operations Facility: Elevation Fenestration

Figure 5.27
Wing Headquarters Facility:
Daylit Entry Lobby with Translucent Panel System

Another option for introducing daylight into a facility is the use of insulating translucent panels, which may be used both for vertical applications or skylights. These panels are not typically found on Base, with a couple of exceptions being the Wing Headquarters and 28th Squadron Operations facilities (*see Figure 5.27)*. This lack of insulating translucent panels on Base may be a result of the other methods used to introduce light into facilities, such as clerestory windows. However, the benefit of this type of product is that the thermal performance is greater than a typical insulating glass unit. These units provide opportunities for bringing natural daylight into facilities, but because they are not glass, they do not present hazards to occupants in the case of an explosive event. Translucent panels have been approved for use in lieu of glazing by the US Army Corps of Engineers Protective Design Center, and no further design analysis is required (unlike glazing assemblies). Pre-manufactured translucent skylight assemblies are encouraged; however, translucent panels should not be used as part of a roof assembly without prior coordination with, and concurrence of, HQ ACC/A7PS. Wherever skylights are utilized

on a facility, careful detailing must be included to prevent water leakage, unacceptable snow build-up, etc. Insulating glass unit skylights should be avoided because of their tendency for water spotting and dirt build-up.

- *Use thermally-enhanced glazing products*
- *Incorporate daylight and views into building interiors*
- *Provide sun control devices to avoid glare*
- *Consider use of insulating translucent panels in both vertical and sloped applications to provide interior daylight*

Figure 5.28
Wing Headquarters Facility: Roof Form

Roof Features and Forms

Building roofs should be designed to achieve the following: to maintain a weather-tight barrier; to facilitate ease of maintenance; to maintain color and appearance retention for those roofs exposed to view; and to provide a long life-span. On-going roofing maintenance is a major concern to the Base, and alleviating these maintenance issues should be the primary function of roof design.

The type of roof system selected for a project should be a direct reflection of the building form (*see Figure 5.28)*. Buildings with large floor plates should consider a low-slope membrane roofing in a light color, complying with reflectivity requirements of sustainable design and high-performance green building principles. As an option, a sloped standing seam metal roof may be used, such as those currently installed on many of the hangars. Because of the shear mass of these hangar facilities, the additional height of a sloped roof does not dwarf the building below.

For smaller facilities, a sloped standing seam metal roof may be used, provided that the geometries of the building floor plate do not create an overly complicated roof form, which would be prone to water infiltration. For these types of facilities, a low-slope membrane roofing may be more appropriate in providing a long life-span and low maintenance roof.

Standing seam metal roofs on existing facilities are typically dark brown to medium gray in color. Unfortunately, these existing roofs do not meet the reflectivity requirements of sustainable design and high-performance green building principles, but newer finishes in these darker colors are being introduced to the market to achieve the minimum SRI of 29 required for steep-sloped roofs. These products should be considered on future projects. Ultimately, the exposed roof color should complement the overall aesthetic of the building (*see Figure 5.29)*.

Figure 5.29
Maintenance Group Headquarters Facility: Roof Feature

The newer facilities on Base predominantly use a standing seam metal roof system. The designs of these facilities have been largely successful due to the following accommodations regarding the roofing system: the use of long, linear floor plates to prevent the sloped roof from being too massive; the use of breaks in the roof plane to introduce clerestory windows; the use of glazed monitors to introduce daylighting into the facility; and the use of deep overhangs to preclude the need for gutters and downspouts (*see Figure 5.30)*. Special attention must be paid to the design of the eaves and fascia, to prevent water from migrating back across the soffit. And care should be exercised when doing these types of roofs to include proper detailing and installation to insure a weather-tight finished product.

There are many examples on Base of successful standing seam metal roofing installations, such as the AF Financial Services Center, the 34th Squadron Operations facility, the 37th Squadron Operations facility, and the Base Civil Engineering Administration facility.

The roofing solution will be an outcome of the development process, and should not be determined beforehand. A standing seam metal roof may be an appropriate solution for some facilities, as long as its use does not preclude achieving other sustainable design and high performance green building requirements.

Avoid locating equipment on the roof that would be exposed to view. Roof-mounted equipment should be screened to avoid visibility from the ground. Avoid mounting vents and equipment on standing seam metal roofs to the greatest extent possible. If unavoidable, insure proper detailing of curbs and flashing to create a weather-tight enclosure.

Figure 5.31
Weapons System Training Facility: Entry Roof Form

Facilities on Base tend not to use roof features over a facility's main entrance to impart prominence, but instead oftentimes opt for grandly-scaled glazed curtainwall systems. A notable exception to this is the Weapon Systems Trainer facility, with its arched roof forming a canopy at the main entrance (*see Figure 5.31)*. Future projects should consider including canopies or roof elements over entrances, in order to provide protection from the elements, as well as to impart a feeling of prominence and sense of procession. Care should be taken to insure that any exposed structure incorporated into the canopy design is not conducive to roosting birds.

- *Select roof system to accommodate building form and massing*
- *Utilize roofing systems that are low-maintenance and provide a long life-span*
- *Incorporate roof elements at building entries*

Figure 5.30
34th & 37th Squadron Operations Facilities: Standing Seam Metal Roofs

Other Building Features

Other building features which must be considered in the design of new facilities are as follows: gutters and downspouts; porticos; canopies; courtyards; overhead sectional doors; louvers; mechanical yard enclosures; and dumpster enclosures. These building elements must be integrated into the overall design of any new facility.

The new facilities on Base have demonstrated a concerted effort to eliminate gutters and downspouts, instead relying on deep roof overhangs to shed the roof water away from the base of the building *(see Figure 5.32)*. Whereas this solution may be acceptable for some facilities, other facilities may require the use of gutters and downspouts. In these situations, downspouts should be incorporated into the overall aesthetic of a facility in such a way that they do not cause maintenance concerns in the future, such as by building them into the exterior envelope.

Porticos and canopies are not that common on Base, but their use should be encouraged in future facilities. The design of porticos and canopies should complement the facility architecture, as well as provide opportunities to create pleasant exterior spaces adjacent to the facility. Porticos and canopies should provide protection from the elements, as appropriate, and should provide a sense of enclosure for the space. These exterior "rooms" enhance the quality of life for Base personnel, and oftentimes create a more human scale for a facility.

Figure 5.33
Rushmore Center: Courtyard Space

In lieu of porticos and canopies, the use of courtyards is a prevalent design feature on Base *(see Figure 5.33)*. These courtyards are a result of the oftentimes linear plans incorporated into facility design, and create exterior rooms sheltered from the ever-present

Figure 5.32
Rushmore Center: Use of Deep Roof Overhangs to Eliminate Downspouts and Gutters

Figure 5.34
Screened Mechanical Yard

winds. Use of courtyards should be encouraged in future facilities, along with the inclusion of porticos or canopies to create defined spaces within the larger courtyard area. Landscaping should also be included to reinforce the feeling of an exterior oasis.

Overhead sectional doors and louvers need to be considered in the design of any facility. Their location is obviously dependent on the functional requirements of the building design, but care should be exercised not to locate these elements adjacent to the main facility entrance or on the main façade. Air intake louvers must comply with Anti-Terrorism/ Force Protection requirements. If these items must be located on highly-visible facades, they should be integrated into the overall aesthetic of the facility.

Exterior mechanical and electrical equipment should be located in mechanical yards, and visually screened. The screen wall should complement the overall aesthetic of the facility, while at the same time providing air circulation as required for the equipment and access for maintenance *(see Figures 5.34 and 5.35)*. Screened mechanical yard enclosures also need enclosure on top to comply with Anti-Terrorism/Force Protection requirements.

Every facility should include a dumpster enclosure, located remotely from the building to comply with Anti-Terrorism/Force Protection requirements. The dumpster enclosure should complement the overall aesthetic of the adjacent facilities.

- *Avoid the use of gutters and downspouts*
- *Incorporate porticoes and canopies to create outdoor rooms*

Figure 5.35
Screened Mechanical Yard

[6.1] Acronyms & Abbreviations

AAFES	Army and Air Force Exchange Service
AB	Air Base
ABA	Architectural Barriers Act - Guidelines for Accessibility
ABB	A Manufacturer of Power Products or Systems
ABS	Acrylonitrile Butadiene Styrene
ACC	Air Combat Command
ACGIH	American Conference of Government Industrial Hygienists
ADA	Americans with Disabilities Act
ADAAG	Americans with Disabilities Act Architectural Guidelines
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
AFCESA	Air Force Civil Engineer Support Agency
AFFF	Aqueous Film Forming Foam
AFH	Air Force Handbook
AFI	Air Force Instruction
AFMAN	Air Force Manual
AFOSH	Air Force Occupational Safety and Health
AFPM	Air Force Pamphlet Manual
AFR	Air Force Requirement
AHJ	Authority Having Jurisdiction
AIC	Alternate Intensity Current
AICUZ	Air Installation Compatible Use Zone
AMDS	Aerospace Medicine Squadron
ANSI	American National Standards Institute
ARPA	Archaeological Resources Protection Act
ARR	Appearance Retention Rating
ASCA	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASSE	American Society of Sanitary Engineering
ASTM	American Society for Testing and Materials
ATFP	Anti-Terrorism Force Protection
AWWA	American Water Works Association
BCE	Base Civil Engineer (Commander)
Exchange	Base Exchange
BTU	British Thermal Unit
CADD	Computer Aided Design Drafting
CATV	Community Area Television
CBC	California Building Code
CCB	Construction Criteria Base
CE	Civil Engineer
CEF	Base Fire Chief
CEP	Programs Flight
CER	Communications Equipment Room

CFM	Cubic Feet per Minute
CEO	Operations Flight
CES	Civil Engineer Squadron
CEV	Environmental Flight
CMU	Concrete Masonry Units
COE	Corps of Engineers
COMM	Communications
CPSC	Consumer Product Safety Commission
CPT	Cone Penetration Test
CRC	Criteria Review Conference
CS	Communications Squadron
CSC	Consolidated Support Center
CSP	Corrugated Steel Pipe
dBA	Decibels (acoustic)
DCG	Design Compatibility Guide
DDC	Direct Digital Control
DGS	Deployable Ground Station
DOC	Department of Commerce
DoD	Department of Defense
DODDS	Department of Defense Dependents Schools
DOE	Department of Energy
DX	Direct Expansion
ECP	Entry Control Point
EIA	Electronic Industries Association
EIAP	Environmental Impact Analysis Process
EIFS	Exterior Insulation Finish System
EMCS E	Energy Monitoring Control System
EO	Executive Order
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
ETL	Engineering Technical Letter
FF	Federal Flammability
FFA	Federal Flammability Agency
FFE	Finished Floor Elevation
FGS	Final Governing Standards
FM	Factory Mutual Global
FOC	Fiber Optic Cable
FOD	Foreign Object Damage
FR	Flame Retardant
FS	Federal Standard
FSP	Final Sketch Plan
GFI	Ground Fault Interrupter
GIS	Geographical Information System
GPG	Grains per gallon
GPS	Global Positioning System
HDPE	High Density Polyethylene
Hi-X	High-Expansion
HM/HW	Hazardous Materials/Hazardous Waste

HQ	Headquarters
HVAC	Heating, Ventilating and Air Conditioning
IAPMO	International Association of Plumbing and Mechanical Officials
IAW	in accordance with
IBC I	International Building Code
IDS	Intruder Detection System
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IEQ	Indoor Environmental Quality
IESNA	Illuminating Engineering Society of North America
IP	International Protection
IPC	International Plumbing Code
IR	Infrared
ISO	International Organization for Standardization
IWW	Industrial Waste Water
LAN	Local Area Network
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LPS	Lightning Protection System
LSC	Life Safety Code
LV	Low Voltage
MCP	Military Construction Program
MDOS	Medical Operations Squadron
MUTCD	Manual on Uniform Traffic Control Devices
MV	Medium Voltage
MWR	Morale, Welfare, and Recreation
NAGPRA	Native American Graves Protection and Repatriation Act
NEC	National Electrical Code
NEMA	National Electrometric Manufacturers Association
NESC	National Electric Safety Code
NFC	National Fire Code
SD&HPGB	Sustainable Design & High Performance Green Buildings

[6.2] Installation Functional Constraints and Considerations

6.2.1 General

The following section 6.3 provides installation-centric background information and identification of functional-technical considerations necessary for a fully successful design. It identifies preferred systems and technical components and is intended to describe best practices related to planning, architecture, engineering and interior design. It identifies materials, furnishing, systems, practices, approaches, and finishes historically used and having proven success over time. It is not intended to serve as a comprehensive list of all applicable building codes, regulations, directives, references or to identify facility centric or unique user requirements. Functional-Technical Constraints and Considerations need to be specifically addressed in the Basis of Design analysis written during the concept development phase and the design development phase. Understanding the driving forces behind these constraints and considerations will greatly contribute to a successful project outcome.

6.2.2 Brand Name References

References to equipment, materials, articles, or patented process by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and not construed as limiting competition.

[6.3] Ellsworth AFB Technical Design Guide

TABLE OF CONTENTS

[SECTION 1] PARKING & SITE

1.1 Parking and driveways must be asphalt or concrete paved over an appropriate base material, with concrete curbs and painted parking stripes. Provide parking quantities to comply with Air Force Facilities Requirements.

1.2 Main entrances must be wheelchair accessible. Provide all other accessible elements required by law. (see CECN)

1.3 Roof design, gutters and downspout placement must be coordinated to protect entrances, allow water drainage away from the building and controlled to avoid washing over or onto walkways.

1.4 Lighting of the parking area providing a minimum illumination of 1 footcandle at parking surface throughout all paved areas is required. Lamp source shall be high pressure sodium.

1.5 Exterior electrical power outlets are required at the building perimeter, including the main entrances.

1.6 Parking must be located at least 25m from the building.

1.7 All light poles, flag poles or any metal poles are to be round steel. Concrete, square steel, or fiberglass may be acceptable.

1.8 Minimal islands in parking lots for easy snow removal. Coordinate with federal mandates regarding storm water management.

1.9 Grassed or landscaped areas, to promote good drainage, shall slope 1’ in the first 10’ from building.

1.10 Bollards shall be steel, concrete filled, in industrial type areas and concrete at offices, commercial and public areas. Lighted bollards may be required.

1.11 Verify drainage with Environmental Section to ensure compliance.

[SECTION 2] LANDSCAPING

2.1 Landscaping shall include moderate to low maintenance grass, trees and planting beds as required.

2.2 Low level landscaping must surround the perimeter of the building, excluding sidewalks and curbs. Landscaping in this space shall include a combination of grass/shrubs. Planting beds must include a variety of 4-6 shrubs minimum.

2.3 Parking areas must be landscaped to comply with local zoning requirements.

2.4 An underground irrigation sprinkler system is required to serve all planting beds. Sprinkler systems shall have winter blow out provisions and back flow preventer.

2.5 Landscaping should provide cooling, shading, snow control and water shed.

2.6 Planting beds & trees located around buildings should have an equal mixture of young to mature plants and trees.

2.7 All landscaping must be kept a minimum of 10m from the building for inspection of briefcase sized items.

2.8 No bark or wood chip mulch is allowed.

[SECTION 3] BUILDING EXTERIOR

3.1 The exterior design must coordinate with other existing buildings located on base.

3.2 Brick masonry walls may be accented with precast concrete bases, cut stone, string courses and/or cornices.

3.3 Masonry patterning is encouraged to provide a sense of scale to the building and to articulate building entrances.

3.4 Metal buildings are only allowed for hangars and industrial type buildings.

3.5 Gutters and downspouts are not required on buildings with pitched roofs.

3.6 Rain diverters and snowguards are required at all entrances.

BUILDING EXTERIOR SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Sloped roofs	Metal standing seam		07611
Flat roofs	**Fully adhered membrane**		07531
Siding: Brick Stone Precast	 Scratch face, modular, etc. Smooth face, 2" veneer Simulated natural cut stone	 Brown tones or gray tones Neutral tones Neutral tones	 04813 04853 04720
Soffit, rake and fascia	Vented soffit, smooth metal clad fascia.	Complement color to roof or building color	07611
Gutters and downspouts *optional	6"x6" Ogee prefinished metal gutters with debris screens and rectangular downspouts.	Match color of roof	07714
Windows	Aluminum or wood (metal clad exterior), low-E insulated glass.	anodized finish or clad color to match exterior. Interior wood-red oak.	08520 (alum.) 08550 (wood) 09900 (stain)
Window Sills	Solid Surfacing (no wood sills)	Neutral tones	06600
Doors : Hollow metal Alum/glass	 Painted finish Insulated glass.	(to match building) Neutral tone anodized finish	 09900 (paint) 08410
Entry lights	Recessed cans controlled by photocell or wall mounted fixtures.	Color to complement building exterior.	16510

[SECTION 4] EXTERIOR SIGNAGE

4.1 Exterior signs shall serve to identify buildings, inform users and direct vehicular traffic. For all exterior sign requirements refer to Design Compatibility Standard Book.

4.2 Continuity of materials, fonts and colors is recommended.

4.3 Letter style for signs is Helvetica. Helvetica medium shall be used for primary information and Helvetica regular shall be used for secondary information.

4.4 Individual lettering attached to building structures, monuments and entryway glass shall be metallic, beige or white.

4.5 Materials for signs shall be galvanized steel and non-ferrous materials, such as brick and cut stone.

4.6 If lighting of signs is required, use flood or spotlights.

4.7 Size and location of exterior signs must be approved by the 28th Civil Engineer Squadron and conform to signage regulations.

4.8 Building identification signs may be one or two sided.

Building Identification Sign Example

Individual Lettering Example

[SECTION 5] ENTRANCES

5.1 A vestibule at the main entry is required. The vestibule must clearly define entrance into the building and may be centered on building.

5.2 An entrance mat in the vestibule is required to comply with LEED Requirements.

5.3 Auxiliary entrances to the building are recommended and fire code may be required.

5.4 Security locks must be provided at controlled entrances to the building. All entrance locations should be well lit.

5.5 Main entrances shall be a pair of glass doors. Full glass sidelights on each side are recommended. Automatic door openers may be required.

5.6 Fluorescent lighting is to be used in vestibules and main entrances. In unheated areas provide low temperature ballasts.

VESTIBULE AND MAIN ENTRANCE SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	Square quarry tile	Neutral tones-gray or beige	09300
Base	4" to 6" high cove base	Match floor	09330
Entrance mat	Carpeted treads	Neutral color	12486
Walls	Vinyl wallcovering with scrim backing, Type II, 18-20 oz., Class A, 54" wide	Varies, light neutrals with subtle pattern or texture.	09720
Ceiling	Textured or smooth painted gypsum board, flat paint.	Pure white or neutral	09900 (paint)
Doors	Full-glass aluminum doors. Insulated glass.	Clear anodized finish.	08410
Door frames	Aluminum frames.	Clear anodized finish.	08410
Security	Outside door always unlocked. Inside door has coded entry lock.	Chrome	08710
Lighting	Recessed fluorescent.	Chrome or white	16510

AUXILIARY ENTRANCE SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Doors	Hollow metal or full-glass aluminum door with insulated glass.	Clear anodized finish. Dark bronze	08410 (alum.) 08114 (hollow metal)
Door frames	Hollow metal or aluminum frame. Painted finish.	Match doors	08410 (alum.) 08115 (hollow metal)
Security	Coded entry lock.	Chrome	08710

[SECTION 6] CORRIDORS & STAIRS

6.1 Corridors should be no less than 44" wide.

6.2 Electrical power outlets for cleaning equipment are required at least every 50 feet center-to-center.

6.3 Electrical panels should not be located in corridors. Any electrical panel in a corridor must be painted to blend with wallcovering colors and must be equipped with locking covers.

6.4 Fire extinguishers must be accessible and installed in cabinets, either unlocked or with break glass devices. Provide type of extinguisher at locations to meet codes.

6.5 Exit and emergency lighting are required.

6.6 Consider wall protection rail in high traffic areas.

CORRIDOR SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	Dense textured nylon level loop, woven polypropylene backing, stretched over pad or double glue application. Optional bordering.	Varies, minimum of 6 colors. Background color must be medium to dark hue. Neutral.	09686
Base	4" vinyl cove base.	Match color from carpet.	09650
Walls	Vinyl wallcovering with scrim backing, Type II, 18-20oz., Class A, 54" wide	Varies, light to medium neutrals with subtle pattern or texture.	09720
Door casing	Red oak, traditional style.	Natural or stained finish.	09900 (stain)
Corner guards	Screw-attached or self adhesive clear plastic	Clear at wallcovering	10260
Ceiling	Painted smooth gypsum board ceiling or suspended acoustical panels 2'x2' with revealed edges and at 7'-10" or higher is recommended.	White or off-white	09510 (panels) 09900 (paint)
Fire extinguisher	Recessed or semi-recessed cabinets with view glass	White	10523
Lighting	Recessed or surface mounted fluorescent type.	Chrome or white	16510
Emergency lighting	Surface mounted battery pack with dual flood lamps.	White	16510
Accent lighting	Wall sconces are recommended, fluorescent.	Chrome, brass or painted to match wall covering.	16510

EXIT STAIRS SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Landing	Rubber to match tread and risers. square pattern.	Neutral tones	09650
Treads & risers	Rubber tread with raised square pattern. Square nosing.	Neutral tones.	09650
Handrails	Steel with painted finish.	Neutral tones. Off set color of stair treads and risers.	05520
Walls	Painted smooth or textured finish.	Off-white or neutral	09900
Ceiling	Painted smooth gypsum board ceiling or textured finish.	White or neutral	09900
Lighting	Bar lighting located at each landing-Ceiling hung, fluorescent.	White	16510
Emergency lighting	Surface mounted battery pack with dual flood lamps.	White	16510

Stairwell Example

Corridor Example

[SECTION 7] EXECUTIVE OFFICES

7.1 Executive offices shall be sized according to base requirements.

7.2 Minimum of three duplex outlets, one telephone outlet, and two voice data outlets for computer must be provided. Located for flexible room configuration requirements.

7.3 Soundproofing is required in walls adjacent to other office areas.

7.4 Indirect lighting may be used in rooms with 9-foot ceilings minimum.

EXECUTIVE OFFICE SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	Dense textured nylon level loop, woven polypropylene backing, stretched over pad or double glue down applications. Optional bordering.	Varies, minimum of 6 colors. Background color must be medium to dark hue. Neutral.	09686
Base	Red oak base. Traditional style.	Natural or stained finish.	09900
Walls	Vinyl wallcovering with scrim backing, Type II, 18-20oz., Class A, 54" wide.	Varies, light neutrals with subtle pattern or texture.	09720
Chair rail	Red oak, traditional style. 3' off floor.	Natural or stained finish.	09900
Corner guards	Self adhesive or screw attached clear plastic	Clear at wallcoverings	10260
Ceiling	Painted & textured gypsum board or suspended acoustical panels 2'x2' with revealed edge.	White Pure white	09510 (panels) 09900 (paint)
Doors	Solid core oak wood doors.	Natural or stained finish.	08212 (door) 09900 (stain)
Door frame	Oak frame. Case with traditional style hardwood, both sides.	Natural or stained finish.	08212 (frame) 09900 (stain)
Security	Coded entry locks.	Chrome	08710
Lighting	Mix of recessed cans on dimmer controls and recessed 2'x2' fluorescent. Suspended fluorescent.	white	16510
Decorative lighting	Wall sconces for accent, fluorescent.	Brass, chrome or finish to match wall covering.	16510

Executive Office Example

[SECTION 8] CONFERENCE ROOMS

8.1 Conference rooms shall be sized according to base requirements.

8.2 Rooms should be column-free and walls of gypsum board must have ½" minimum of soundboard either sealed to structure or with sound batts above the ceiling.

8.3 Storage for chair, tables, podiums, etc. shall be located adjacent to conference rooms.

8.4 Each separate conference room must have its own individually controlled HVAC system and control.

8.5 Minimum of one duplex outlet per wall, one telephone outlet, one voice data outlet for computer and one television outlet must be provided in each conference room.

8.6 Provide white boards, chalk boards, manual pull down screens or electrically operated pull down screens as required.

8.7 Suspended fluorescent indirect lighting may be used in rooms with 9 foot ceiling heights minimum.

CONFERENCE ROOM SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	Dense textured nylon level loop, woven polypropylene backing, stretched over pad or double glue down applications. Optional bordering.	Varies, minimum of 4 color choices. Background color must be medium to dark hue. Neutral.	09686
Base	4" to 6" red oak base, traditional style	Natural or stained finish.	09900
Walls	Vinyl wallcovering with scrim backing, Type II, 18-20oz., Class A, 54" wide.	Varies, light neutrals with subtle pattern or texture.	09720
Chair rail	Oak chair rail, traditional style. 3' off floor.	Natural or stained finish.	09900
Corner guards	Self adhesive or screw attached clear plastic	Clear at wallcoverings	10260
Ceiling	Suspended acoustical panels 2'x2' with revealed edge or painted smooth finish.	White Pure white	09510 (panels) 09900 (paint)
Doors	Solid core wood doors.	Medium stained wood.	08212 (door) 09900 (stain)
Door frame	Oak frame. Case with traditional style hardwood, both sides.	Natural or stained finish.	08212 (frame) 09900 (stain)
Security	Coded entry locks.	Chrome	08710
Lighting	Mix of recessed cans on dimmer controls and recessed 2'x2' fluorescent. Suspended fluorescent.	white	16510
Decorative lighting	Wall sconces on dimmer switches, fluorescent.	Brass, chrome or finish to match wall covering.	16510

[SECTION 9] CLASSROOMS

9.1 Classrooms shall be sized according to base requirements.

9.2 Rooms shall be column free and walls of gypsum board must have ½" minimum of soundboard either sealed to structure or with sound batts above the ceiling.

9.3 If temporary partitions are required they should be acoustically designed folding panels.

9.4 Storage for chairs, tables, podiums, etc. shall be located adjacent to classroom.

9.5 Coat racks in or near each classroom are required.

9.6 Built in cabinets may be required.

9.7 Floor outlets are required, if room is used for computer instruction, for any portion of the classroom floor that is greater than 8 feet from the wall and shall be spaced not more than 16 feet apart from each other. Minimum of one duplex outlet per wall is required.

9.8 One telephone outlet minimum and must provide adequate voice/data outlets for computers.

9.9 Provide white boards, chalk boards, manual pull down screens or electrically operated pull down screens as required.

9.10 Suspended fluorescent indirect lighting may be used in rooms with 9 foot ceilings minimum.

9.11 Each classroom should have ventilation capability with fresh air and heating/cooling. Individual controls for each classroom are required.

CLASSROOM SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	Dense textured level loop, woven polypropylene backing, stretched over pad or double glue down applications. Optional bordering.	Varies, minimum of 4 color choices. Background color must be medium to dark hue. Neutral.	09686
Base	4" high vinyl cove base.	Match color in carpet.	09650
Walls	Textured and painted gypsum board.	Off-white or neutral.	09900
Folding partitions	Acoustically treated core with cloth surface.	Solid pattern-neutral colors to coordinate with carpet.	10651
Corner guards	Self adhesive or screw attached clear plastic	Clear at wallcoverings	10260
Ceiling	Suspended acoustical panels 2'x2' with revealed edge or painted smooth finish.	White Pure white	09510 (panels) 09900 (paint)
Doors	Solid core wood doors.	Medium stained wood.	08212 (door) 09900 (stain)
Door frame	Oak frame. Case with traditional style hardwood, both sides.	Natural or stained finish.	08212 (frame) 09900 (stain)
Security	Coded entry locks.	Chrome	
Lighting	Mix of recessed cans on dimmer controls and recessed 2'x4' fluorescent. Suspended fluorescent.	White	16510

[SECTION 10] OFFICES (STANDARD)

10.1 Standard office size shall be according to base requirements.

10.2 Minimum of two electrical duplex outlet, one telephone outlet and one voice data computer outlet per desk is required, locate as required.

10.3 Suspended fluorescent indirect lighting may be used in rooms with 9 foot ceilings minimum.

OFFICE SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	Dense textured nylon level loop, woven polypropylene backing, double glue down application.	Varies, minimum of 6 colors. Background color must be medium to dark hue. Neutral.	09686
Base	4" high vinyl cove base.	Match color from carpet.	09650
Walls	Texture and painted gypsum board.	Off-white or neutral	09900
Ceiling	Suspended acoustical panels 2'x2' with revealed edge or smooth painted finish.	White Pure white	09510 (panels) 09900 (paint)
Door	Solid core oak wood door.	Natural or stained finish.	08212 (door) 09900 (stain)
Door frame	Oak frame with trim on each side or hollow metal.	Natural or stained finish. Paint neutral tone.	08212 (frame) 09900 (paint) 09900 (stain)
Lighting	Surface mounted or recessed 2'x4' fluorescent. Suspended fluorescent.	White	16510

Standard Office Example

[SECTION 11] PUBLIC RESTROOMS

11.1 Single or multiple fixture restrooms are required by code to meet ADA specifications.

11.2 Install fixtures, accessories and items in accordance with manufacturer's instructions.

11.3 GFI outlet at lavatory.

11.4 HVAC – minimum of 10 air changes per hour exhaust rate.

PUBLIC RESTROOM SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	6″ to 12″ square slip resistant ceramic tile	Neutral tones-beige or cream	09300
Base	4″ high ceramic tile cove base.	Match wall tile.	09300
Walls	4″x4″ ceramic tile wainscot 5 feet with painted smooth finish above.	Varies, off-white or neutral with matte or glazed finish	09300 (tile) 09900 (paint)
Ceiling	Suspended acoustical panels 2′x2′ with revealed edges or smooth painted finish.	White	09510 (panels) 09900 (paint)
Doors from Corridor (optional)	Solid core oak wood doors. Brass kick plate.	Natural or stained finish.	08212 (door) 09900 (stain)
Door frame	Oak frame with trim on each side.	Natural or stained finish.	08212 (frame) 09900 (stain)
Toilet partitions	Metal, baked enamel finish, floor or ceiling mounted. Wall mounted urinal screens.	Off-white or neutral	10160
Toilet tissue dispensers	Dual roll, surface mounted.	Polished stainless steel	10800
Soap dispenser	Surface mounted liquid soap.	Polished stainless steel	10800
Paper towel Dispenser/ Waste Receptacle	Surface mounted.	Polished stainless steel	10800
ADA accessories	Grab bars and toilet accessory mounting locations required by code.	Polished stainless steel	10800
Mirror	Ground edges, full width from splash to 6′-4″ AFF	NA	08830
Vanity & sink	Solid surface, 20″ top with integral sink and 4″ splash.	Subtle patterning-neutral tones	06600
Sink faucet and drain	Commercial grade lever handle faucet with grid strainer.	Chrome plated brass	15410
Toilet and urinal	Flush valve with elongated bowl, open front seat and no lid.	white	15410
Lighting	Decorative traditional vanity fluorescent fixture wall mounted over mirror. Additional recessed fluorescent 2′x2′ for large restrooms.	Chrome or white	16510

[SECTION 12] BREAK ROOMS

12.1 Locate centrally to office areas.

12.2 A laminate countertop with base cabinets, sink, microwave and refrigerator are required. Wall cabinets are recommended.

12.3 One wall telephone outlet and one television outlet with cable hook up is required. Minimum of one outlet per wall and one outlet per every 24" at countertop.

12.4 Ventilation capability with fresh air and exhaust.

12.5 Natural lighting is suggested in conjunction with other light sources.

BREAK ROOM SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	12"x12"x1/8" vinyl composition tile.	Light neutrals with patterning.	09650
Base	4" high vinyl cove base.	Match floor.	09650
Walls	Textured walls with paint.	Off-white or neutral	09900
Ceiling	Suspended acoustical panels to match corridor or paint smooth finish.	White Pure white	09510 (panels) 09900 (paint)
Door	Solid core oak wood door.	Natural or stained finish.	08212 (door) 09900 (stain)
Door frame	Oak frame with trim on each side.	Natural or stained finish.	08212 (frame) 09900 (stain)
Lighting	Recessed or surface mounted fluorescent.	White	16510
Cabinets	Laminated base and upper cabinets.	Solid light neutral color.	12350
Countertops	Laminated with oak edging. Oak-natural or stained finish.	Light neutral color with subtle patterning to coordinate with cabinets & floor covering.	12350 (laminate) 09900 (stain)
Sink	Stainless steel, single bowl or double, 15"x 17", self-rimming.	Stainless steel	15410

Break Room Example

[SECTION 13] STORAGE AREA

13.1 Storage rooms for extra supplies, furniture, fixtures, equipment and archived records should be located according to office requirements.

13.2 Painted wood shelves are recommended for this type of storage. Shelving must be securely anchored to structural members or wood blocking.

13.3 Minimum of one duplex outlet.

STORAGE AREA SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	12"x12"x 1/8" square vinyl composition tile, class II.	Light neutrals with patterning.	09650
Base	4" high vinyl cove base.	Match floor.	09650
Walls	Painted smooth finish.	Off-white or white	09900
Ceiling	Suspended acoustical panels to match corridor or painted smooth finish. Paint exposed pipes, ducts, and conduits.	White	09510 (panels) 09900 (paint)
Door	Solid core oak door.	Natural or stained finish.	08212 (door) 09900 (stain)
Door frame	Hollow metal. Case with oak trim, corridor side only.	Paint neutral tones to match corridor wall covering. Trim-natural or stained finish.	08112 (frame) 09900 (paint) 09900 (stain)
Lighting	Recessed or surface mounted fluorescent with acrylic lens only.	White	16510

[SECTION 14] UTILITARIAN AREA

14.1 Workbench with heavy-duty pegboard on back wall is required.

14.2 Electrical power outlets as required.

14.3 One wall telephone outlet is required.

14.4 Supply mop racks and shelves as required for minimal storage of janitorial items.

UTILITARIAN AREA SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	12"x12"x 1/8" square vinyl composition tile, Class II	Light neutrals with patterning.	09650
Base	4" high vinyl.	Match floor.	09650
Walls	Paint smooth finish	Off-white or neutral	09900
Sink	Free standing or wall mounted laundry sink.	Fiberglass	15410
Ceiling	Suspended acoustical panels to match corridor or painted smooth finish. Paint exposed pipes, ducts, and conduits.	White	09510 (panels) 09900 (paint)
Door	Solid core oak door.	Natural or stained finish.	08212 (door) 09900 (stain)
Door frame	Hollow metal. Case with oak trim corridor side only.	Paint neutral tones to match corridor wall covering. Trim-natural or stained finish.	08112 (frame) 09900 (paint) 09900 (stain)
Lighting	Recessed or surface mounted fluorescent with acrylic lens only.	White	16510

[SECTION 15] ELEVATORS

15.1 Elevators are required for buildings having three or more stories. Elevators for two story buildings are recommended and may be required to meet ADA requirements.

15.2 Locate elevator in center of building adjacent to corridors. A minimum landing of 5' by 10' is required, and landing may overlap corridor.

15.3 Consult with a commercial elevator supplier for code information, service contract information and building requirements.

15.4 Elevator hall doors must be brushed stainless steel.

15.5 Elevator car doors and control panels must be brushed stainless steel.

15.6 Elevator floor to match corridor carpet.

15.7 Elevator car walls must be plastic laminate clad to match building décor.

15.8 Elevator car ceiling may be translucent diffuser with fluorescent lighting above.

15.9 Elevator shafts meeting all codes are required. Concrete masonry unit shaftwall construction is recommended for sound and vibration control.

15.10 Elevator machine rooms meeting all codes are required. Concrete masonry unit wall construction is recommended for sound control.

15.11 Elevator recall, smoke detectors, shutdown, etc. per ANSI standards for elevators.

Elevator Example

[SECTION 16] DORMITORY ROOMS

16.1 Dormitory room size shall be according to base requirements.

16.2 Check base requirements for dormitory room furniture.

16.3 Minimum of one electrical duplex outlet, one telephone outlet, one voice data computer outlet per desk area and one television outlet with cable hook-up is required.

16.4 Soundproofing is required in walls adjacent to other dormitory rooms.

16.5 Each dormitory room must have its own individually controlled HVAC system and control.

16.6 Message board located on each corridor door.

DORMITORY ROOM SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	Dense textured nylon level loop, woven polypropylene backing, double glue down application.	Varies, minimum of 6 colors. Background color must be medium to dark hues. Neutral.	09686
Base	4" high vinyl cove base.	Match color from carpet.	09650
Walls	Textured and painted gypsum board.	Off-white or neutral.	09900
Ceiling	Suspended acoustical panels to match corridor or painted texture finish.	White Pure white	09510 (panels) 09900 (paint)
Doors	Solid core oak doors.	Natural or stained finish.	08212 (doors) 09900 (stain)
Door frame	Oak frame with trim on each side.	Natural or stained finish.	08212 (frame) 09900 (stain)
Lighting	Recessed or surface mounted fluorescent fixtures.	White	16510

Dormitory Room Example

[SECTION 17] DORMITORY BATHROOMS

17.1 Single fixture bathrooms may be required by code to ADA specifications.

17.2 Install fixtures, accessories and items in accordance with manufacturer's instructions.

17.3 GFI outlet at lavatory.

17.4 HVAC – minimum of 10 air changes per hour exhaust rate.

DORMITORY BATHROOM SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	2″x2″ square slip resistant ceramic tile.	Neutral tones–beige or cream	09300
Base	4″ high ceramic tile cove base.	Match floor tile.	09300
Walls	Textured and painted gypsum board.	Off-white or neutral.	09900
Ceiling	Painted smooth gypsum board.	Pure white	09900
Doors	Solid core oak wood door.	Natural or stained finish.	08212 (door) 09900 (stain)
Door frame	Hollow metal. Case with oak trim-both sides.	Paint neutral tone to match door. Trim-natural or stained finish.	08112 (frame) 09900 (paint) 09900 (stain)
Tub/shower units	Fiberglass tub with shower surround, two piece unit.	Off-white or neutral	15410
Bathtub faucet/shower control	Lever handle, diverter spout and shower head with bent arm & flange.	Chrome plated brass	15410
Shower walls	4″x4″ ceramic tile.	Varies, off-white or neutral with matte or glazed finish.	09300
Shower floor	1″x1″ square slip resistant ceramic tile.	Neutral tones-coordinate with floor tile.	09300
Shower faucet	Hand held shower head, single lever water control.	Chrome plated brass	15410
Cabinets	Laminated custom cabinets.	Neutral solid color.	12350
Countertop/ sink	Solid surface, 20″ top with integral sink and 4″ splash.	Subtle patterning – neutral tones.	06600
Sink faucet & drain	Commercial grade lever handle faucet with grid strainer.	Chrome plated brass.	15410
Mirror	Ground edges; full width from splash up to 5′ high.	NA	08830
ADA accessories *if required	Grab bars and toilet accessory mounting locations required by code.	Polished stainless steel	10800
Toilet	Flush valve with elongated bowl, open front seat and no lid.	White	15410
Lighting	Decorative traditional vanity fluorescent fixture, wall mounted over mirror	Chrome or white	16510

[SECTION 18] WEIGHT ROOM

18.1 Room size will vary depending on equipment needs.

18.2 Sufficient ventilation is required.

18.3 Electrical wall or floor outlets should be located according to equipment placement.

18.4 Minimum of one television outlet with cable hook-up may be required.

18.5 Double door from corridor may be required.

18.6 Heavy rubber mats to be used under heavy weight equipment.

WEIGHT ROOM SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	Rubber tile.	Neutral tone.	
Base	4″ high vinyl cove base.	Match color from floor covering.	09650
Walls	Textured & painted gypsum board.	Off-white or neutral	09900
Ceiling	Suspended acoustical panels 2′x2′ with revealed edges or painted smooth.	White Pure white	09510 (panels) 09900 (paint)
Door from Corridor	Solid core oak wood door.	Natural or stained finish.	08212 (door) 09900 (stain)
Door frame	Hollow metal. Case with oak trim both sides.	Paint neutral tone to match door. Trim – natural or stained finish.	08112 (frame) 09900 (paint) 09900 (stain)
Mirrors	¼ inch thick, ground edges, glue to wall. Provide channel & clips.	Stainless steel channel & clips.	08830
Lighting	Recessed or surface mounted 2′x2′ fluorescent.	White	06510

Exercise Room Example

[SECTION 19] LAUNDRY AREA

19.1 Locate floor drain in laundry area as required by code.

19.2 Recessed wall cabinet with ironing board may be required.

19.3 Supply sufficient washer and dryer hook up stations.

19.4 GFI outlet by laundry sink area.

19.5 Area for clothes rod may be required.

LAUNDRY AREA SPECIFICATIONS			
ITEM	**DESIGN STYLE**	**DESIGN CRITERIA**	**SPECIFICATION REFERENCE**
Floor	6″ to 12″ Square slip resistant ceramic tile	Neutral tones-medium color range	09300
Base	4″ high vinyl cove base	Match color of floor tile	09650
Walls	Textured & painted gypsum board	Off-white or neutral	09900
Ceiling	Suspended acoustical panels 2′x2′ with revealed edges or painted smooth	White Pure white	09510 (panels) 09900 (paint)
Door from Corridor	Solid core oak wood door	Natural or stained finish	08212 (door) 09900 (stain)
Door frame	Hollow metal. Case with oak trim both sides.	Paint neutral tone to match door. Trim – natural or stained finish.	08112 (frame) 09900 (stain) 09900 (paint)
Lighting	Recessed or surface mounted 2′x2′ fluorescent.	White	16510
Cabinets	Laminated cabinets-base only.	Light neutral color-solid no patterning.	12350
Countertops	Laminated top with cut out for sink.	Coordinate with cabinets-neutral color with subtle patterning.	12350
Sink	Stainless steel, single bowl, 15″x17″, self-rimming.	Stainless steel	15410
Sink Faucet	Gooseneck, metal lever handles.	Polished chrome finish.	15410

Laundry Room Example

[SECTION 20] INTERIOR SIGNAGE

20.1 Interior signage must provide information and direction in an efficient manner and be consistent in appearance.

20.2 Overall sign dimensions will vary based on message.

20.3 ½" thick acrylic with routed edges and acrylic face is required.

20.4 Provide raised Grade II Braille.

20.5 Letters to be in Aldine Style, 2" tall x 1/16" thick, acrylic.

20.6 Interior signs are to be located at door entrances from corridors. Additional signage may be required at main front entrances for directional purposes.

20.7 Removable name area is required for signage designating positions outside of offices.

Multiple Room Use Sign Example

Position Designation Sign with Removable Name Area Example

Typical Room Designation Sign Example

[SECTION 21] TRASH DISPOSAL AREA

21.1 Dumpster enclosure is required. Enclosure, meeting local requirements, must fully conceal the dumpster from three sides at ground level view and coordinate with the exterior materials, colors and detailing of the main building. One side of enclosure is to be open with no obstructions.

21.2 Remodel work on existing buildings requires updating or adding dumpster enclosures. Metal screen fencing, at least 6 feet tall, can be used as enclosure material.

21.3 Locate dumpster areas away from entrances, convenient to service areas and accessible to truck pick-up service. Dumpster areas are located a minimum of 10m away from the building.

21.4 A concrete pad for the dumpsters is required.

Masonry Dumpster Enclosure

Mechanical Equipment Enclosure

[SECTION 22] MECHANICAL & PLUMBING

22.1 A central mechanical room or rooms shall contain heating and cooling equipment, domestic hot water equipment, plumbing and miscellaneous equipment.

22.2 A complete plumbing system of waste lines, vents, cold water supply and re-circulating hot water supply is required.

22.3 Hot and cold domestic water supply system must provide a minimum of 40 psi pressure to all fixtures.

22.4 Mechanical engineer is responsible for verifying the water pressure at the site is a minimum of 55 psi.

22.5 Domestic hot water system must provide a minimum of 105 degrees F and a maximum of 110 degrees F temperature to all dormitory unit fixtures and 160 degrees F to laundry areas.

22.6 Water softening system should be provided if certain applications require soft water such as boiler makeup.

22.7 Central four-pipe building heating and cooling system may be provided for large properties. If provided, dormitory units must have heating and cooling available year-round with individual
controls.

22.8 Gas supply system is recommended for water heaters, laundry areas and central heating systems.

22.9 Corridors may have a central HVAC system or floorboard heating or both depending on length of corridor.

22.10 Dormitory bathroom exhaust system may be either ducted through a fan in the attic or a centrifugal fan on the roof serving multiple rooms.

22.11 Public restrooms should be provided with exhaust systems capable of at least 10 air changes per hour of fresh air and exhaust.

22.12 Mandatory use of water-back-flow prevention devices is required to isolate industrial plumbing from any other system.

22.13 Use lead free solder as per National Standard Plumbing Code 1996.

22.14 Heat transfer fluid reservoirs are suggested in mechanical rooms if hot water boilers are used.

22.15 Flush plumbing system for lead prior to occupancy.

[SECTION 23] ELECTRICAL

23.1 In addition to all other Ellsworth AFB Standards, all electrical work shall be done in accordance with the National Electric Code (NFPA 70) and the National Electrical Safety Code (NESC).

23.2 A central electrical room or rooms shall contain main switchgear equipment. Additional spaces on each floor for panelboards are recommended and may be maid closets, storage rooms or similar.

23.3 A complete electrical system of transformer, switchgear, panelboards, grounding, conductors, raceways and fittings must be provided.

23.4 Electrical entrances must be underground and shall be sized to provide power for all electrical needs.

23.5 Coordinate all electrical power outlets, phone jacks and television jacks with furniture layout and equipment.

23.6 Lighting at each building entrance is required. All interior lighting, except decorative or accent lighting, shall be fluorescent type fixtures, unless HID in high ceiling applications.

23.7 Dimmer controls are required in all conference rooms and classroom type areas.

23.8 GFI outlets must be provided in wet areas where required by code.

23.9 Lighting shall be controlled by occupancy sensors as appropriate for function and as allowed by code.

[SECTION 24] TELEPHONE, TELEVISION & OTHER SYSTEMS

24.1 Telephone system including underground entrance, backboard, space for equipment, conduits, boxes, wiring, jacks and equipment are required in construction contract. All work shall be in accordance with Ellsworth Airforce Base and EIA/TIA Standards for Category 5 cabling system.

24.2 Television system including space for equipment, conduits, boxes, wiring, jacks and equipment are required in construction contract.

24.3 Computer system including space for equipment, conduits, boxes, wiring, jacks and equipment are required in construction contract. All work shall be in accordance with Ellsworth Airforce Base and EIA/TIA Standards for Category 5 cabling systems.

24.4 Locate telephone, television and computer equipment in conditioned space isolated from activities and per manufacturer's requirements.

24.5 Security systems, closed circuit camera and recorders to monitor areas are optional.

24.6 If generator is required, verify type and size is applicable.

[SECTION 25] LIFE SAFETY SYSTEMS

25.1 Building fire alarm system with automatic detection, pull stations, audio/visual alarms and a central annunciator panel is required. Provide additional remote alarms inside coded areas to overcome wall sound insulation and ambient room noise. All work shall be done in accordance with NFPA 72.

25.2 Emergency light system and illuminated exit signage are required in accordance with code.

25.3 Unitary smoke detectors in dormitory rooms and all other sleeping areas must be provided in accordance with code and must not be connected to the building fire alarm system. Unitary smoke detectors shall be hard wired to the buildings power system and be provided with battery backup.

25.4 Fire suppression sprinkler system is required. Sprinkler heads should be a recess mount and quick reaction type. Application of wet or dry pipe is to be determined by designer.

25.5 Fire extinguishers are required.

25.6 Provide window openings in dormitory rooms when required by code.

25.7 Areas of refuge located in stairwells of all buildings having an elevator are recommended. Areas of refuge may be required by code.

25.8 Smoke detectors are required in duct system and need to be connected to the buildings fire alarm system capable of HVAC shutdown when activated.

[SECTION 26] SOUND ISOLATION

26.1 Walls and floor/ceilings of dormitory rooms, conference rooms and classrooms adjacent to public areas other than corridors must provide airborne sound transmission coefficient STC of 50 or greater.

26.2 Exhaust ducts in bathrooms must be designed to minimize sound transfer between areas.

26.3 Power outlets, switches, telephone jacks and television jacks in guest units must be offset 24 inches from similar items on opposite sides of wall cavities, and the space between must be effectively sound insulated.

26.4 Toilet and shower drain pipes in dormitory bathrooms must be sound insulated from the start of the drain to the main stack.

26.5 Ductwork that allows sound to be transmitted from one room to another is not recommended.

26.6 All exterior windows must have insulated glass.

26.7 In areas that receive direct exterior road or airplane noise, additional exterior wall and roof/ceiling acoustical design may be necessary. Specially designed window frames and or panes may be required.

[SECTION 27] WINDOW, DOORS & DOOR HARDWARE

27.1 Windows must either be a fixed unit with or without an operable hopper vent with fixed glazing.

27.2 Window area shall vary due to building design. If replacing window units during remodel work, keep window area the same size or down size window area if required.

27.3 Window glass must have low-emmisivity coating and dual panes with vacuum or gas filled space between panes. Frames must be extruded aluminum or wood windows with pre-finished clad exterior.

27.4 Windowsills must be solid surfacing. Hard wood sills can be used if specified.

27.5 Doors in corridors must be solid core wood doors. All interior non- corridor doors can be flush hollow core.

27.6 Exterior doors shall be extruded aluminum with double pane gas filled glass. Sidelights may be required made from same material.

27.7 Door frames in corridors must either be welded or knockdown hollow metal or hardwood. Knock down frames with flange that are flush with walls are recommended for attachment of wood trim on both sides or corridor side only as required.

27.8 Door hardware shall be heavy-duty commercial grade.

27.9 Door hardware finish shall match existing.

27.10 Door locksets and latches shall have lever handles. Privacy locks for dormitory rooms should match existing.

27.11 Push button coded locks are required on doors for building entrances, conference rooms, classrooms, and certain offices.

27.12 Wall doorstops must have solid wood blocking support in wall cavities.

27.13 Fire rated doors and frames shall be located when required by code, and shall include closers. Fire rated doors and frames are required to have rating tags and are not to be painted.

27.14 Windows may be required to have a fire rating.

[SECTION 28] BLOCKING

28.1 Provide wood blocking in wall cavities for attachment of all miscellaneous artwork, wall sconces, mirrors, mop racks, window coverings and wall mounted toilet units.

28.2 In storage rooms, provide wood blocking in wall cavities for attachment of built-in shelf supports.

28.3 Provide wood blocking in wall cavities for attachment of all base and wall cabinets.

28.4 Provide wood blocking in wall cavities for attachment of all wall-mounted doorstops.

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

29.1 Summary

1. These Product Specifications are not intended for construction. Professionally prepared specifications are required for construction purposes.

2. These Product Specifications are intended as a guideline to understand the concept of Ellsworth Air Force Base compatibility design standards.

3. All materials and products shall be evaluated and approved by the 28th Civil Engineer Squadron prior to specification for construction.

29.2 Product Requirements

1. Manufacturers listed in these Product Specifications:

a. All materials and products shall be installed as per manufacturer's standards or specifications. Complete work to satisfaction of 28th Civil Engineer Squadron to provide a quality facility.

b. The exclusion of a product or manufacturer from these Product Specifications does not exclude them from consideration. Any substitutions must meet written approval by the 28th Civil Engineer Squadron.

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

04720 CAST STONE

Summary:

1. Precast Concrete Masonry:
   a. Vast color selection-coordinate color with exterior finishes.
   b. Structural detailing available.
   c. Special shapes and sizes available.
   d. Signage available.

Approved Manufacturers:

1. Stonco Inc.
   4924 Poppleton Ave.
   Omaha, NE 68106
   (402) 556-5544

2. Thunder Stone
   3300 South 6th Street
   Lincoln, NE 68502
   (402) 420-2322

3. Dallas Cast Stone Company Inc.
   4107 Hancock Street
   Dallas, TX 75210
   (214) 428-6269
   www.dallasstone.com

4. Gage Brothers Concrete Products Inc.
   P.O. Box 1526
   Sioux Falls, SD 57101
   (605) 336-1180

Cast Stone Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

04813 BRICK MASONRY

Summary:

1. Clay Brick Masonry:
   a. Neutral colors-vast color selection.
   b. Size-modular, scotty, utility, triple, meridian.
   c. Special shapes available.
   d. 8000 + PSI.

2. Concrete Masonry Units:
   a. Neutral colors-vast color selection.
   b. Size-4", 6", 8", 10", 12".
   c. Textures-scratch, split, burnish, glaze, natural.
   d. Fire rated units available.

Approved Manufacturers:

1. Hebron Brick Company
   P.O. Box 509
   1543 Deadwood Avenue
   Rapid City, SD 57709
   (605) 343-3733

2. Dakota Block Company
   P.O. Box 2920
   Rapid City, SD 57709
   (605) 342-6070

3. Sioux City Brick
   501 Orpheum Building P.O. Box 807
   Sioux City, IA 51102
   (712) 258-6571

4. Gage Brothers Concrete Products Inc.
   P.O. Box 1526
   Sioux Falls, SD 57101
   (605) 336-1180

Brick Masonry Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

04853 NATURAL STONE VENEER

Summary:

1. Natural Stone:
   a. Finishes (polished, honed, thermal, split, natural)
   b. Vast color selection-coordinate color with exterior finishes.
   c. Types of stone (granite, limestone, sandstone, slate).
   d. Various sizes and shapes.

Slate Example

Approved Manufacturers:

1. Cold Springs Granite
   202 South Third Avenue
   Cold Springs, MN 56320-2593
   (612) 259-3400

2. Vetter Stone Company
   Route 5, Box 41, P.O. Box 38
   Kasota, MN 56050
   (507) 345-4568

3. Brock White Company
   1243 Eagan Industrial Road
   Eagan, MN 55121
   (651) 686-5036

4. State Stone Corporation
   4640 South 300 West
   Salt Lake City, UT 84107

Limestone Example

Granite Example

Sandstone Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

05520 METAL RAILINGS

Summary:

1. Metal Railing:
   a. ADA compliant.
   b. 1 ½ inch diameter round steel.
   c. Steel-epoxy painted finish.

Approved Manufacturers:

1. Summit Steel Fabricators, Inc. *
   2004 Federal Road
   Houston, TX 77015
   (713) 451-6960

2. American Stair Corp. *
   642 Forestwood Drive
   Romeoville, IL 60446-1354
   (800) 872-7824

3. Julius Blum & Company *
   P.O. Box 816
   Carlstadt, NJ 07072-0816
   (800) 526-6293

4. Tri Tech, Inc. *
   5710 Harrison Avenue
   Austell, GA 30106
   (770) 944-0020

Metal Railing Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

06600 SOLID SURFACING

Summary:

1. Vanity Countertops & Integral Sinks:
   a. Vanity top, ¾" thick.
   b. Matte finish.
   c. Cut out for drop-in china bowl sink is optional.

2. Laundry/Break Room Countertops
   a. Countertops ¾" thick
   b. Matte finish.
   c. Cut out for stainless steel sinks.

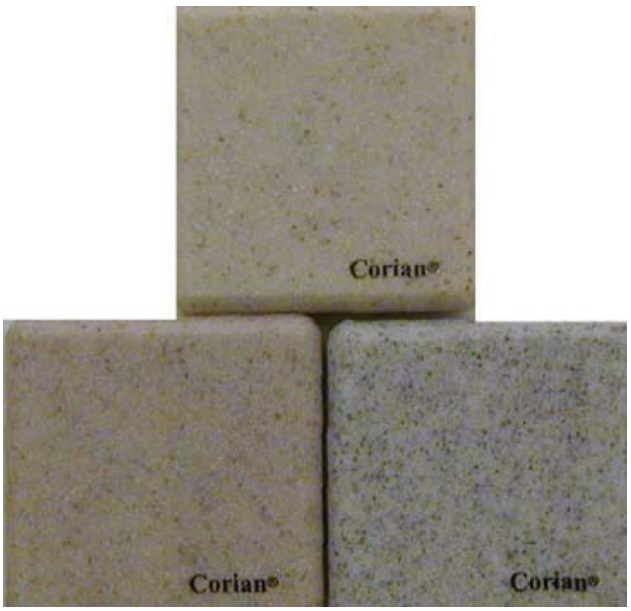
3. Window Sills
   a. Sill, ½" thick.
   b. Matte finish.

Approved Manufacturers:

1. Dupont Company *
   1007 Market Square
   Wilmington, DE 19898
   (302) 774-6260

2. Avonite *
   1945 Highway 304
   Belen, NM 87002
   (800) 428-6648

3. Transolid, Inc. *
   2599 Charlotte Highway
   Mooresville, NC 28117
   (800) 766-2452



Solid Surface Samples (Neutral Colors with Subtle Patterning)

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

07531 MEMBRANE ROOFING

Summary:

1. Membrane roofing:
   a. Fully adhered system.
   b. 60 mil. thickness.

Approved Manufacturers:

1. Celotex Corp. *
   4010 Boy Scout Blvd.
   Tampa, FL 33607
   (813)873-1700

2. GenFlex Roofing Systems *
   1722 Indian Wood Circle, Suite A
   Maumee, OH 43537
   (800) 443-4272

3. Sta Fast Roofing *
   7095 Americana Parkway
   Reynoldsburg, OH 43068
   (800) 225-4714

4. Versico, Inc. *
   3485 Fortuna Drive
   Akron, OH 44312
   (330) 644-6700

EPDM Membrane Roof Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

07611 – METAL STANDING SEAM ROOFING

Summary:

1. Metal Standing Seam Roofing:
   a. Standing seam with batten.
   b. 16” seam spacing.
   c. Mechanically seamed.
   d. Meet building code fire-exposure and uplift resistance requirements.

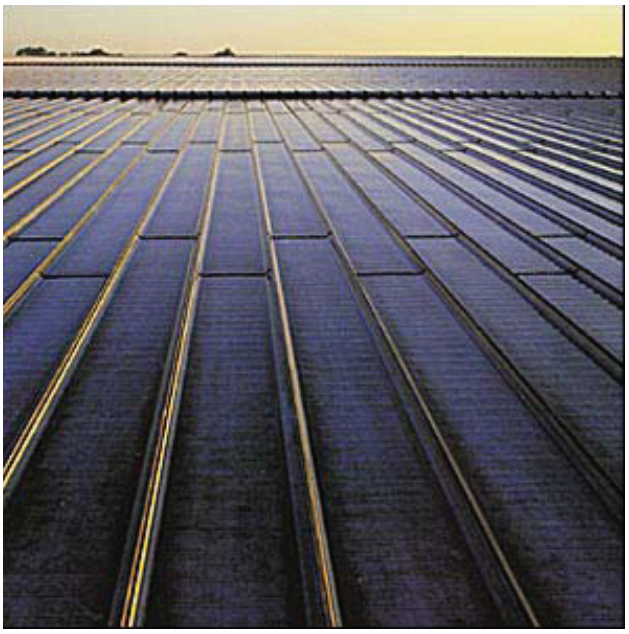
Approved Manufacturers:

1. Steelox Systems, Inc. *
   5412 Courseview Drive
   P.O. Box 8181, Suite 300
   Mason, OH 45040
   (513) 573-5200

2. Butler Manufacturing Company *
   700 Karnes Blvd.
   P.O. Box 419917
   Kansas City, MO 64141
   (816) 968-3000

3. Englert, Inc. *
   1200 Amboy Ave.
   Perth Amboy, NJ 08861
   (732) 826-8614

4. Metal Sales Mfg. Corp. *
   7800 States Road 60
   Sellersburg, IN 47172
   (812) 246-0819



Metal Standing Seam Roof Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

07714 GUTTERS AND DOWNSPOUTS

Summary:

1. Gutters & Downspouts:
   a. Pre-finished aluminum ogee gutters.
   b. Pre-finished aluminum rectangular downspouts.
   c. Color to match roofing material.

Approved Manufacturers:

1. Architectural Products Co. *
   2644 Crescent Springs Road
   Covington, KY 41017
   (606) 341-1171

2. CopperCraft *
   2143 Joe Field Road, Suite 100
   Dallas, TX 75229
   (800) 486-2723

3. Deer Mountain Gutter & Insulation
   31038 Blue Bird Court
   Sturgis, SD 57785
   (605) 423-4312

4. ABC Seamless Gutters
   2091-B Rand Road
   Rapid City, SD 57702
   (605) 341-3953

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

08114 HOLLOW METAL DOORS & FRAMES

Summary:

1. Hollow metal doors & frames:
   a. Exterior/Interior frames-16 gage core thickness.
   b. Door core, polystyrene insulation.
   c. Fabricated frames as welded units.
   d. Fire rating & ADA requirements may apply.
   e. Prime/painted finish.

Approved Manufacturers:

1. Steelcraft Mfg. Co. * 9017
   Blue Ash Road
   Cincinnati, OH 45242
   (513) 745-6400

2. Overly Door Co. *
   574 W. Otterman
   Greensburg, PA 15601-0070
   (724) 834-7300

3. Fleming Steel Doors & Frames *
   A United Dominion Company
   20 Barr Road
   Ajax, ON L1S 3X9
   (905) 683-3667

4. American Metal Door Co., Inc. *
   615 South H
   Richmond, IN 47375
   (800) 428-2737

Hollow Metal Door & Frame Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

08212 WOOD DOORS & FRAMES

Summary:

1. Entrance and Interior French doors:
   a. Solid red oak.
   b. Insulated glass at exterior.
   c. 1 ¾ inch thick.
   d. Side lights optional.
   e. Fire rating & ADA requirements may apply. (Rating Tag required)

2. Corridor and other solid core doors:
   a. Flush panel design.
   b. 1 ¾ inch thick.
   c. Solid red oak
   d. Brass kick plates recommended.
   e. Side lights optional.
   f. Fire rating & ADA requirements may apply. (Rating Tag required)

Approved Manufacturers:

1. Pella Corp. *
   102 Main St.
   Pella, IA 50219
   (888) 628-8433

2. Anderson Corp. *
   100 4th Ave. North
   Bayport, MN 55003-1096
   (651) 264-5150

3. Hurd Millwork Co. *
   575 S. Whelen Ave.
   P.O. Box 319
   Medford, WI 54451
   (715) 748-2011

4. Marvin Windows & Doors
   P.O. Box 100
   Warrad, MN 56763
   (800) 346-5044
   www.marvin.com

Interior Solid Oak Door Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

08410 STOREFRONT DOORS

Summary:

1. Swinging Aluminum Entrance Door System:
   a. Single swinging doors and frames.
   b. Butt hinges or pivots.
   c. Low-E insulated glass, dual pane with ½" argon gas pocket.
   d. Anodized finish on frame.
   e. Glazing to be tempered.
   f. Sidelights may be required.
   g. ADA requirements may apply.

Approved Manufacturers:

1. Kawneer Co., Inc. *
   555 Guthridge Court
   Norcross, GA 30092
   (770) 449-5555

2. Tubelight Inc. *
   4878 Mackinaw Trail
   Reed City, MI 49677
   (616) 832-2211

3. United States Aluminum
   200 Singleton Drive
   Waxahachie, TX 75165
   (972) 937-9651
   www.usalum.com

4. Special-Lite
   P.O. Box 6
   Decatur, MI 49045
   (616) 423-7068
   www.special-lite.com

Store Front Door Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

08520 ALUMINUM WINDOWS

Summary:

1. Aluminum Windows:
   a. Extruded aluminum windows, operable or fixed, fixed glazing.
   b. Thermally broken anodized aluminum frames.
   c. Double-glazing with ½" argon gas.

Approved Manufacturers:

1. Desco Windows
   716 3rd St., SE
   DeSmet, SD 57231
   (800) 952-5534
   desco@1w.net

2. Kawneer Co., Inc. *
   555 Guthridge Court
   Norcross, GA 30092
   (770) 449-5555

3. Tubelight Inc. *
   4878 Mackinaw Trail
   Reed City, MI 49677
   (616) 832-2211

4. Gerkin Windows & Doors *
   P.O. Box 3203
   Sioux City, IA 51102
   (800) 475-5061

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

08550 WOOD WINDOWS

Summary:

1. Wood windows:
   a. Red oak interior-natural or stained finish.
   b. Clad exterior-coordinate color with building exterior.
   c. Sills, hardwood or solid surfacing material.
   d. Operable or fixed window, fixed glazing.
   e. Insulated glass, double glazing with ½" argon gas.

Approved Manufacturers:

1. Pella Corp. *
   102 Main Street
   Pella, IA 50219
   (888) 628-8433

2. Hurd Millwork Co. *
   575 S. Whelen Ave.
   P.O. Box 319
   Medford, WI 54451
   (715) 748-2011

3. Anderson Corp. *
   100 4th Ave. North
   Bayport, MN 55003-1096
   (651) 264-5150

4. Marvin Windows & Doors
   P.O. Box 100
   Warrad, MN 56763
   (800) 346-5044
   www.marvin.com

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

08710 SECURITY LOCKS

Summary:

1. Exterior-Exit Device Controls:
   a. Weather resistant.
   b. All metal front housing.
   c. 6 key combination lock.
   d. Satin chrome finish.
   e. Fully mechanical-not affected by power failure.

2. Interior-Auxiliary Locks:
   a. One-hand operation.
   b. All metal construction.
   c. Satin chrome finish.
   d. Fully mechanical-not affected by power failure.

Approved Manufacturers:

1. ILCO UNICAN *
   2941 Indiana Ave.
   Winston Salem, NC 27105
   (800) 849-8324

Code Entry Lock Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

08830 MIRRORS

Summary:

1. Mirrors
   a. ¼ inch thick.
   b. Ground edges.
   c. Glued to wall. At exercise room and all public restrooms, provide stainless steel channel at bottom and clips at top in addition to glue.

Approved Manufacturers:

1. A.C.I.
   965 Ridge Lake Blvd.
   P.O. Box 171173
   Memphis, TN 38120-1173
   (800) 238-6057

2. Guardian Industries *
   14600 Romaine Road
   Carleton, MI 48117
   (734) 654-6264

3. Arch Aluminum & Glass Co., Inc. *
   10200 Northwest 67th Street
   Tamarac, FL 33321
   (800) 432-8132

4. Marquez Glasseries, Inc. *
   8215B Dorsey Run Road
   Jessup, MD 20794
   (800) 822-4299

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

09300 FLOOR & WALL TILE

Summary:

1. Entrances & Laundry Area-Quarry Tile:
   a. Floor tile, abrasive finish, 8”x8” or 12”x12”.
   b. Cove base, 4” or 6” high.
   c. Colored grout to match tile.

2. Restrooms-Ceramic Tile:
   a. Floor tile, abrasive finish, 2”x2”or 6”x6”.
   b. Wall tile, smooth finish, 4”x4”, border color optional.
   c. Cove base to match wall tile.
   d. Off-white grout.

Approved Manufacturers:

1. Crossville Ceramics *
   P.O. Box 1168
   Crossville, TN 38557
   (931) 484-2110

2. Summitville Tiles, Inc. *
   State Route 644
   P.O. Box 73
   Summitville, OH 43962
   (330) 223-1511

3. Daltile
   7834 C.F. Hawn Freeway
   Dallas, TX 75217
   (800) 933-8453
   www.dtile.com

4. American Olean Tile Company *
   7834 C.F. Hawn Freeway
   Dallas, TX 75217
   (215) 393-2237

Wall Tile with Optional Border Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

09510 ACOUSTICAL CEILING PANELS

Summary:

1. Panels and Grid System (for corridors and typical spaces):
   a. Non-directional fissured wet-felted mineral fiber lay-in panels, 2'x2'x5/8 inches thick with revealed edge.
   b. Formed steel double-web tee grid, 15/16 inches wide, intermediate duty system.

2. Panels and Grid System (for restrooms):
   a. Vinyl-faced gypsum panels for high moisture environment.
   b. Aluminum-web tee grid with, 15/16 inches wide, intermediate duty system.

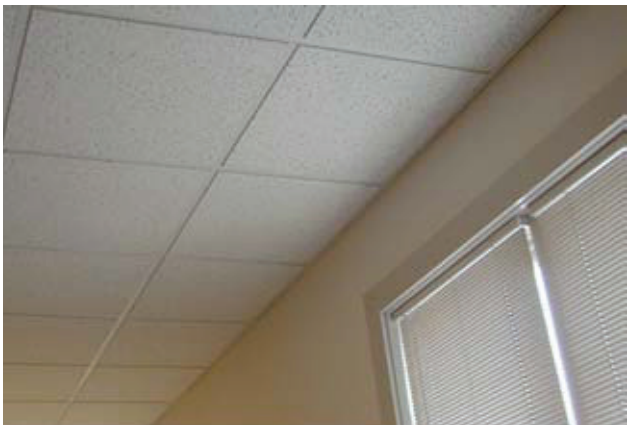
Approved Manufacturers:

1. Celotex Corporation *
   4010 Boy Scout Blvd.
   Tampa, FL 33607
   (813) 873-1700

2. Armstrong World Industries, Inc. *
   Ceiling & Ceiling Systems Division
   P.O. Box 3001
   Lancaster, PA 17604
   (717) 397-0611

3. U.S.G. Interiors, Inc. *
   125 South Franklin
   P.O. Box 4470
   Chicago, IL 60680
   (800) 874-4968

4. Chicago Metallic Corp.
   4849 S. Austin Ave.
   Chicago, IL 60638
   (800) 323-7164
   www.chicago-metallic.com



Acoustical Ceiling Panels Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

09624 RUBBER TILE FLOORING

Summary:

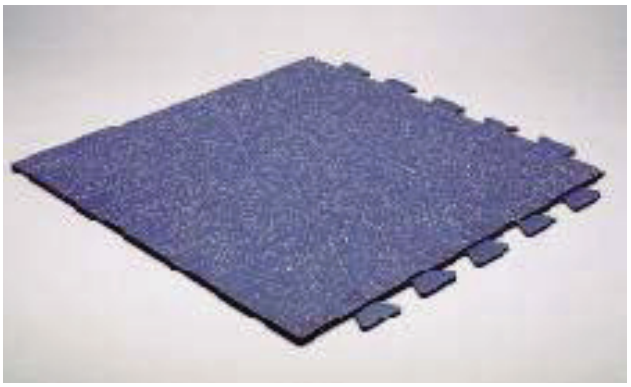
1. Rubber tile-weight room area.
   a. 3/8” inch thick.
   b. Glue down application.
   c. Maximum wear and slip resistance.
   d. Various sizes and colors.

Approved Manufacturers:

1. Pawling Corporation *
   32 Nelson Hill Road
   P.O. Box 200
   Wassaic, NY 12592
   (800) 431-3456

2. Tuflex Rubber Flooring *
   4521 West Crest Ave.
   Tampa, FL 33614
   (800) 543-0390

3. American Floor Products Co., Inc. *
   7977 Cessna Ave.
   Gaithersburg, MD 20879-4167
   (888) 768-2058



Rubber Tile Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

09650 RESILIENT FLOORING

Summary:

1. Vinyl composition tile:
   a. 12”x12”x 1/8”.
   b. No wax finish.
   c. Standard grade.

2. Vinyl/Rubber Base:
   a. 4” high, coved.
   b. Optional – oak cap in corridors.

3. Landing & Treads/Risers:
   a. 1/8” thick rubber design tile.
   b. Raised circular or square pattern.
   c. Solid color – neutral tones.

Approved Manufacturers:

1. Vinyl Composition Tile Manufacturer:

   a. Congoleum Corporation *
   Dept. C 3705 Quakerbridge Rd.
   P.O. Box 3127
   Mercerville, NJ 08619
   1-800-934-3567

   b. Tarkett *
   800 Lanidex Plaza
   Parsippany, NJ 07054
   (201) 428-9000
   1-800-225-6500

   c. AzRock *
   1705 Oliver St.
   P.O. Box 3145
   Houston, TX 77007
   1-800-366-2689

   d. Armstrong *
   2500 Columbia Ave.
   P.O. Box 3001
   Lancaster, PA 17604
   1-800-233-3823

Vinyl Cove Base with Oak Cap Example

Vinyl Composition Tile Samples (Neutral Tones with Subtle Patterning)

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

2. Vinyl Cove Base Manufactures and Landing & Treads/Riser Design Tile Manufacturers:

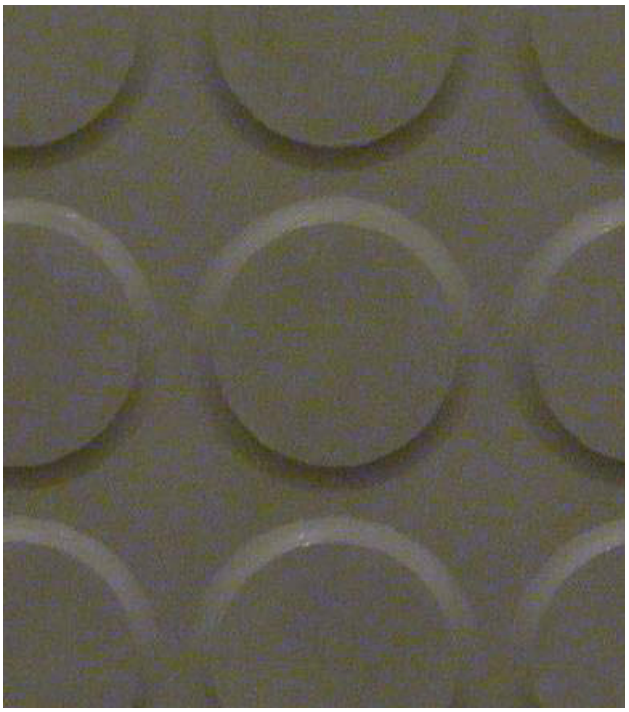
   a. Burke Flooring Products *
   2250 S. 10th St.
   San Jose, CA 95112
   1-800-669-7010

   b. Johnsonite *
   16910 Munn Road
   Chagrin Falls, OH 44023
   1-800-899-8916

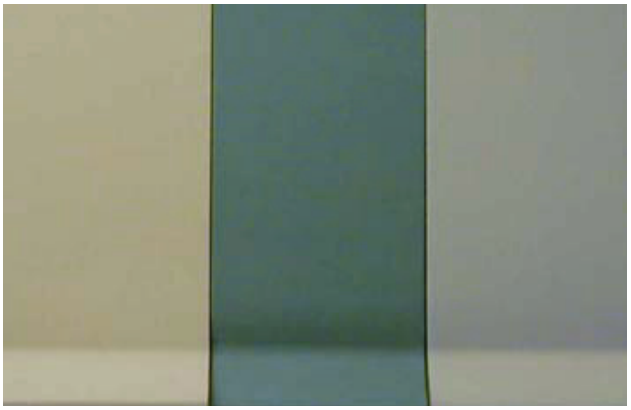
   c. Roppe *
   1602 N. Union Street Box 1158
   Fostoria, OH 44830-1158
   1-800-537-9527

   d. V.P.I. *
   3123 South 9th St.
   P.O. Box 451
   Sheboygan, WI 53082
   1-800-874-4240

Stair Design Tile Example (Square Pattern)



Stair Design Tile Example (Circular Pattern)



Vinyl Cove Base Examples (Solid Colors to Match Color from Floor Covering)

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

09686 CARPET

Summary:

1. Sheet Carpeting
   a. Level loop – minimum of 6 colors.
   b. Polypropylene backing.
   c. Borders optional-cut pile, solid color.
   d. Neutral in color- blues, greens, or browns

2. Padding
   a. Standard commercial grade.
   b. No padding - double glue down application.

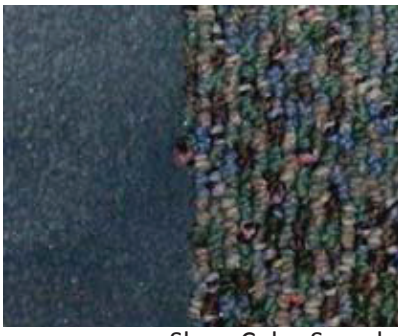
Approved Manufacturers (Sheet Carpeting):

a. Shaw Industries
   P.O. Box 2128
   Dalton, GA 30722-2128
   (706)278-3812/www.shawinc.com
   Product line: Studio one 2 one:
   1. Level loop = Wildcreek
   2. Cut Pile Border = Bay Hill II

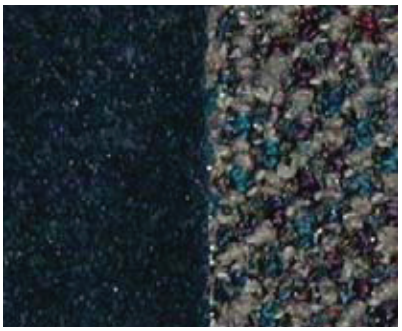
b. J & J Industries
   16475 Ave. North
   Plymouth, MN 55446
   (612) 550-1031
   Product line: Terrestrial
   1. Level loop = Terrestrial Style 4320
   2. Cut Pile Border = Colours Supreme Style 3838

c. Cambridge
   1997 Highway 225 South
   Chatsworth, GA 30705
   1-800-451-1250
   Product Line: Glen Coe
   1. Level loop = Glen Coe
   2. Cut Pile Border = Park Lane

d. DesignWeave
   15305 Valley View Ave.
   Santa Fe Springs, CA 90670
   (310) 921-7209/www.designweave.com
   Product Line: Stratosphere
   1. Level loop = 992 Stratosphere
   2. Cut Pile Border = Windswept Classic



Shaw Color Sample
(Cut Pile Border & Level Loop)



J&J Color Sample
(Cut Pile Border & Level Loop)

Cambridge Color Sample
(Cut Pile Border & Level Loop)

DesignWeave Color Sample
(Cut Pile Border & Level Loop)

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

09720 VINYL WALL COVERING

Summary:

1. Vinyl Wall Covering:
   a. Scrim backing.
   b. Type II, 18-20 oz. recommended.
   c. Light to medium neutral colors with subtle patterning or Texture to hide seaming or wall imperfections.

Approved Manufacturers:

1. Guard Contract Wallcoverings
   1280 N. Grant
   Columbus, OH 43201
   (800) 521-5250

2. D.L. Couch Wallcoverings, Inc.
   3900 S. Memorial Drive
   P.O. Box 570
   New Castle, IN 47362
   www.dlcouch.com

3. Hirshfield's, Inc.
   725 2nd Avenue North
   Minneapolis, MN 55405
   (612) 377-3910
   www.hirshfields.com

4. MDC Wallcoverings
   1200 Arthur Avenue
   Elk Grove, IL 60007
   (800) 621-4006
   www.mdcwallcoverings.com

Vinyl Wall Covering Example (Neutral Color with Subtle Patterning)

Vinyl Wall Covering Example (Neutral Color with Subtle Patterning)

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

09900 PAINTING & STAINING

Summary:

1. Wall Paint:
   a. Eggshell finish
   b. Off-white or neutral color.
   c. Smooth or Orange Peel texture

2. Ceiling Paint:
   a. Flat finish
   b. Pure white
   c. Knockdown, “Popcorn” stipple or smooth texture

3. Wood Stain:
   a. Golden Oak-satin finish
   b. Natural finish

Approved Manufacturers:

1. Sherwin Williams *
   Midwestern Division Office 11410 Alemeda
   Strongsville, OH 44136
   (440) 846-4300

2. Diamond Vogel Paints
   1110 Albany Place S.E.
   Orange City, IA 51041
   (712) 737-4993
   www.diamondvogel.com

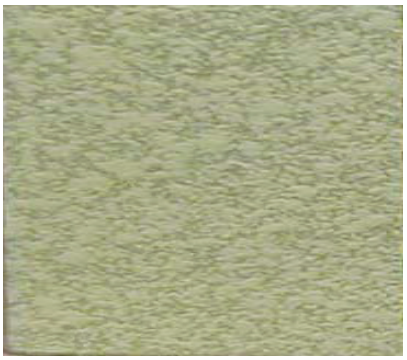
3. Benjamin Moore & Co. *
   51 Chestnut Ridge Road
   Montvale, NJ 07645
   (201) 573-9600

4. Valspar Paints
   1101 Third Street South
   P.O. Box 1461
   Minneapolis, MN 55415
   (612) 332-7371
   www.valspar.com

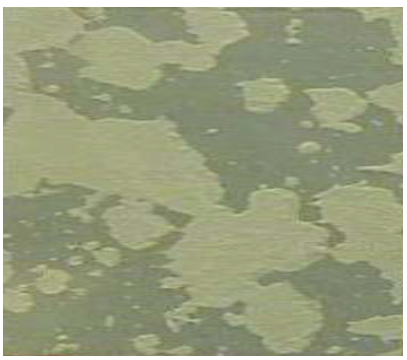
Texture Manufacturers

1. United States Gypsum Co. *
   125 S. Franklin St., Dept 978
   Chicago, IL 60606
   (800) 874-4968

Golden Oak Stain Color Sample



Orange Peel Texture Sample



Knockdown Texture Sample

“Popcorn” Stipple Texture Sample

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

10160 TOILET PARTITIONS

Summary:

1. Toilet Partitions:
   a. Metal partitions with powder coated baked enamel finish.
   b. Neutral colors to coordinate with wall tile or optional border color.
   c. Ceiling or floor mount options.

Approved Manufacturers:

1. Accurate Partitions Corp. *
   P.O. Box 287
   Lyons, IL 60534
   (708) 442-6801

2. Monarch Toilet Partitions, Inc. *
   186 Buffalo Ave.
   Freeport, NY 11520
   (516) 379-2700

3. American Sanitary Partitions Corp.
   300 Enterprise Street
   P.O. Box 99
   Ocoee, FL 34761
   (407) 656-0611

4. Metpar Corp. *
   95 State Street
   Westbury, NY 11590
   (516) 332-2600

Metal Partition Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

10260 WALL CORNER GUARDS

Summary:

1. Colored Corner Guards (at painted walls):
   a. Vinyl/acrylic solid colored plastic.
   b. 1 ½ x1 ½ inches by 4 feet long.
   c. Adhere to wall.
   d. Match to paint color.

2. Clear Corner Guards (at vinyl wallcovering):
   a. Lexan clear plastic.
   b. 1 1/8 x 1 1/8 inches by 4 feet long.
   c. Screw to wall.

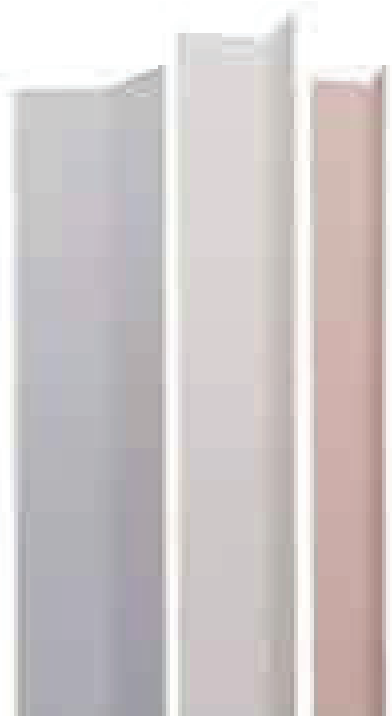
Approved Manufacturers:

1. IPC Door & Wall Protection System,
   InPro Corp. *
   S80 W18766 Apollo Drive
   P.O. Box 406
   Muskego, WI 53150
   (800) 543-1729

2. Arden Architectural Specialties, Inc. *
   151 Fifth Ave. NW, Suite J
   St. Paul, MN 55112
   (800) 521-1826

3. Construction Specialties, Inc. *
   49 Meeker Ave.
   Cranford, NJ 07016
   (908) 272-5200

4. Hager Companies *
   139 Victor Street
   St. Louis, MO 63104
   (314) 772-4400



Color Corner Guard Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

10523 FIRE EXTINGUISHERS & CABINETS

Summary:

1. Fire Extinguisher:
   a. Selected per code requirement.

2. Fire Extinguisher Cabinet:
   a. Semi-recessed.
   b. Full-glass panel.
   c. Steel, baked enamel finish.

Approved Manufacturers:

1. J.L. Industries, Inc. *
   4450 West 78th Street Circle
   Bloomington, MN 55435
   (612) 835-6850

2. Potter-Roemer *
   3100 South Susan Street
   Santa Ana, CA 92704
   (800) 366-3473

3. Larsen's Mfg. Co. *
   7421 Commerce Lane N.E.
   Minneapolis, MN 55432
   (800) 527-7367

Fire Extinguisher/Cabinet Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

10651 FOLDING PARTITIONS

Summary:

1. Panel System:
   a. Acoustical panels with edge seals.
   b. Fabric finish-neutral color to coordinate with carpet color.
   c. 50 STC, minimum.

Approved Manufacturers:

1. Modernfold *
   1711 I Ave., Box 310
   New Castle, IN 47362
   (765) 529-1450

2. Hufcor *
   2101 Kennedy Road P.O. Box 591
   Janesville, WI 53545
   (608) 756-1241

3. Panelfold, Inc. *
   P.O. Box 680130
   Miami, FL 33168
   (305) 688-3501

4. Holcomb & Hoke Mfg. Co., Inc. *
   1545 Van Buren St.
   Indianapolis, IN 46203
   (317) 784-2444

Panel System Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

10800 TOILET ACCESSORIES

Summary:

1. Toilet Tissue Dispenser
   a. Dual roll.
   b. Stainless steel finish.
   c. Surface mounted.

2. Soap Dispenser
   a. Push-up type dispenser.
   b. Chrome plated.
   c. White globe.

3. Paper Towel/Trash Receptacle
   a. Dispenses C-fold paper towels.
   b. Removable waste container.
   c. Surface mounted.
   d. Stainless steel finish.

4. ADA Accessories
   a. 18 gauge stainless steel grab bars.
   b. Concealed or exposed mounting.

Approved Manufacturers:

1. American Specialties, Inc. *
   441 Saw Mill River Road
   Yonkers, NY 10701-4913
   (914) 476-9000

2. Bobrick Washroom Equipment, Inc. *
   11611 Hart Street
   North Hollywood, CA 91605
   (818) 764-1000

3. Bradley Corp. *
   W 142 N 9101 Fountain Blvd.
   Menomonee Falls, WI 53225
   (414) 251-6000

4. Tubular Specialties Mfg., Inc. *
   13011 South Spring Street
   Los Angeles, CA 90061-1685
   (800) 225-5876

Toilet Tissue Dispenser Example

Soap Dispenser Example

Paper Towel/Trash Dispenser Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

12350 LAMINATED CABINETS & COUNTERTOPS

Summary:

1. Laminated Cabinets:
   a. ¾" cabinet core material (minimum).
   b. .030 inch high pressure plastic laminated exterior finish.
   c. Pressure fused white laminate interiors.
   d. Cabinet edging 3mm PVC, match laminate color.
   e. Solid color for upper & base cabinets-neutral tones.

2. Laminated Countertops:
   a. "Ultimate" postformed design.
   b. Rounded edge or solid red oak beveled edge.
   c. 4" high backsplash
   d. ¾" thick solid particleboard core.

Approved Manufacturers:

1. Laminate Manufacturers:
   a. Wilsonart International
      2400 Wilson Place, P.O. Box 6110
      Temple, TX 76503-6110
      (800) 433-3222
      www.wilsonart.com

   b. Formica Corp. *
      10155 Reading Road
      Cincinnati, OH 45241
      (513) 786-3400

   c. Pionite Decorative Surfaces
      One Pionite Road
      Auburn, ME 04210
      (207)784-9111
      www.pionite.com

   d. Avonite *
      1945 Highway 304
      Belen, NM 87002
      (800) 428-6648

Laminated Countertop Color Samples (Subtle Patterning)

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

2. Cabinet Manufacturers:

a. TMI Systems Design Corp.
50 S. Third Ave.
West Dickinson, ND 58601-5595
(800) 456-6716
www.tmisystems.com

b. Nelson Adams, GSI
180 North Sherman Ave.
Corona, CA 92882
(909) 340-2800

c. Stevens Industries, Inc. *
704 West Main Street
Teutopolis, IL 62467
(217) 857-6411

d. BPS Architectural Products *
10816 Fallstone, Suite 505
Houston, TX 77099
(800) 255-9513

Laminated Cabinet Color Samples (Solid Color - No Patterning)

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

12486 ENTRANCE MATS

Summary:

1. Entrance Mats (Vestibule):
   a. Carpeted treads.
   b. Coordinate color with interior carpet color.

Approved Manufacturers:

1. Construction Specialties, Inc. *
   P.O. Box 380
   Muncy, PA 17756
   (888) 834-4455

2. American Floor Products Co., Inc. *
   7977 Cessna Ave.
   Gaithersburg, MD 20879-4167
   (888) 768-2058

3. Turtle Plastics *
   7450 A Industrial Parkway
   Lorain, OH 44053-2064
   (440) 282-8008

4. S Bemco International, Inc. *
   715 North Finn Drive
   Algona, IA 50511
   (515) 295-3902

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

15410 PLUMBING FIXTURES

Summary:

1. Toilets & Urinals:
   a. Commercial grade.
   b. White vitreous china.
   c. Toilet: Elongated bowl, open front seat no lid, 1.6 pgf.
   d. Urinal: Elongated rim, 1.0 pgf.
   e. Toilets – floor mount floor outlet or wall hung back outlet with chair carrier.

2. Restroom Sinks:
   a. Drop-in or wall hung with carrier, white vitreous china, self-rimming.
   b. Commercial grade.
   c. Single bowl.

3. Laundry & Break Room Counter Mounted Sinks:
   a. 18-gage stainless steel, three holes, self-rimming, undercoated.
   b. Size: 15x17 inches.

4. Restroom Faucet & Trim:
   a. Single lever metal handle, ceramic control cartridge, grid strainer, tail piece and p-trap assembly.
   b. Polished chrome finish.

5. Break Room Faucet:
   a. Gooseneck spout, ceramic cartridge, grid drain, tail piece and p-trap assembly.
   b. 5” reach by 9” high.
   c. Metal lever handles.
   d. Polished chrome finish.

6. Shower Faucet:
   a. Polished chrome finish.
   b. Single lever water control.
   c. Hand held showerhead.

7. Laundry Faucet and Trim:
   a. Gooseneck spout, ceramic cartridge, swing spout for Double bowl units, threaded outlet with vacuum breaker Strainer body with plug, tail piece and p-trap
   b. Polished chrome finish.

Drop-in Sink Bathroom Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

Summary (cont.):

8. Utility Sink-Free Standing or Wall Hung Laundry Style:
   a. Fiberglass or molded stone 25”x22”x13” deep.
   b. Wall mount brackets or leg mount.

9. Bathtub/Shower Unit:
   a. Fiberglass tub and surround-2 piece.
   b. Tub size 30”x 60”.
   c. Off-white or neutral color.

10. Bathtub/Shower faucet set:

    a. Polished chrome finish.
    b. Single lever metal handle.
    c. Pressure-balancing mixing valve.
    d. Diverter spout.
    e. 2.5 gpm shower head with bent arm and flange.

Approved Manufacturers:

1. American Standard, Inc.
   1 Centennial Ave.
   Piscataway NJ 08855
   (732) 980-3000
   www.americanstandard.com

2. Elkay Manufacturers Corporation
   2222 Camden Court
   Oak Brook, IL 60523
   (630) 574-8484
   www.elkay.com

3. Zurn Industries
   1801 Pittsburg Ave.
   Erie, PA 16514
   (814) 455-0921
   www.zurn.com

4. Kohler Co.
   444 Highland Dr.
   Kohler, Wisconsin 53044
   (800) 456-4537
   www.kohlerco.com

Laundry/Break Room Sink Example

[SECTION 29] RELATED PRODUCT SPECIFICATIONS

16510 LIGHTING

Summary:

1. Accent Lighting-Wall Sconces:
   a. Chrome, brass or painted metal finish to match walls.

2. Fluorescent Lighting:
   a. 2'x2' recessed or surface mounted.
   b. 2'x4' recessed or surface mounted.
   c. 4-foot surface mounted with acrylic lens.
   d. Suspended indirect.
   e. Recessed cans.

Approved Manufacturers:

1. Lithonia Lighting
   P.O. Box A
   Conyers, GA 30012
   (770) 922-2000
   www.lithonia.com

2. Cooper Lighting
   Customer First Center
   1121 Highway 74 South
   Peachtree City, GA 30269
   (770) 486-4801
   www.cooperlighting.com

3. Columbia Lighting
   3808 N. Sullivan Road
   Spokane, WA 99216
   (509) 924-7000
   www.columbia-ltg.com

4. Prescolite
   1251 Doolittle Drive
   San Leandro, CA 94577
   (510) 562-3500
   www.prescolite.com

Wall Sconce Example