CITY OF FORT COLLINS BUILDING DESIGN STANDARDS were prepared by the Operations Services Department to assist and guide Architects & Engineers (A&E) and City staff in the preparation of designs and contract documents for projects administered by the Department. All shall try to conform to the Standards as applicable to the specific project. This manual includes minimum criteria for specific materials and equipment along with sole-source City standardized systems.

The department responsible for revisions to these Standards is Operations Services. Any individual or department can propose a change to these Standards. Changes should be submitted in writing, along with the justification for the change, to the Director of Operations Services. The proposed change will be presented to the Committee, consisting of representatives from PMPD, Facilities Maintenance, Systems Control, and the Director of Operations Services. If the majority agree, the change will become part of the Standards.

FACILITY SERVICES' BUILDING DESIGN STANDARDS TABLE OF CONTENTS

Revised 11/04

I. GENERAL

A. Introduction

The planning and design standards are to be used as guidelines when developing a design. They are broken down into basic sections: (II.) Site Development - considerations that affect building location, placement, orientation, access, etc; (III.) Building Development philosophical design and planning commentary to be taken into account; (IV.) Specification Requirements; and (V.) Appendix.

Project Design normally progress through three phases:

1. Conceptual design - basic functional layout, community impacts alternatives, site considerations, and estimated costs are developed.

2. Preliminary design-alternatives are developed, limited technical design is done, functional layout is completed, public impact/comments are incorporated into design, and estimated costs are refined.

3. Final design - the technical specifications and drawings are prepared to complete the contract documentation, a final project cost estimate is developed.

B. Purpose Of Standards

1. It is not the intent of this Standard to cover in detail all types of buildings. However, the Standards established herein are to be used as a design reference for buildings constructed by the City of Fort Collins. This is not to be a substitution for the technical competence expected of a design or engineering professional; therefore, any recommended changes should be provided to Operations Services Staff.

2. This standard deals with new construction, alterations/remodels, and repairs to existing buildings.

3. For each specific project only the applicable portions of the standard are to be used.

C. Design And Construction

1. Design and construction shall conform to or exceed the minimum applicable standards of the City of Fort Collins Zoning and Building Codes, the Fort Collins' Energy Code for commercial, industrial and high-rise residential buildings, Fort Collins' City Plan, and the ADAAG

2. With respect to additional governing jurisdictional authorities, they shall be referred to as supportive and/or in addition to the City Building Code requirements when applicable. The following authorities shall be considered in any given project design:

    - Poudre Fire Authority
    - Larimer County Health Department
    - City of Fort Collins Community Planning and Environmental Services
    - City of Fort Collins Utility Services
    - City of Fort Collins Cultural Library and Recreation Services
    - City of Fort Collins Transportation Services

3. Specific Code requirements are to be adhered to when referring to kitchen facilities, restroom facilities, fire fighting access and fire exiting/life safety aspects, swimming/wading pools and HVAC systems.

4. <u>Abbreviations</u>

ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADAAG	ADA Accessibility Guidelines for Buildings and Facilities
AlA	American Institute of Architects
ANSI	American National Standards Institute
ARI	Air Conditioning & Refrigerations Institute
ASA	American Standards Association
ASHRAE	American Society of Heating, Refrigeration & Air Conditioning
ASLA	American Society of Landscape Architects
ASM	American Society of Metals
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASTM	American Society for Testing & Materials
CSI	Construction Specifications Institute
IES	Illuminating Engineering Society
NCMA	National Concrete Masonry Association
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
PCA	Portland Cement Association
UBC	Uniform Building Code
UL	Underwriter's Laboratories, Inc.
UPC	Uniform Plumbing Code

D. Environmental Policies

1. Prohibited Materials. The use of the following materials is prohibited on all projects:

   - Products containing asbestos.
   - Products containing urea formaldehyde.
   - Products containing polychlorinated biphenyls.
   - Solder or flux containing more than 0.2 percent lead and domestic water pipe or pipe fittings containing more than 8 percent lead.
   - Paint containing more than 0.06 percent lead.

2. Lead-Based Paint in Alteration or Demolition Projects. When alteration or demolition requires sanding, burning, welding or scraping painted surfaces, test the paint for lead content. If lead is found, implement the controls required by OSHA in 29 CFR 1926.62.

3. Recycled Materials. Architects and Engineers should use recycled materials to the maximum extent practical and economically viable within the project requirements.

4. Prior to occupancy, run a purge cycle of 100% outside air for several days.

E. Demolition

Prior to commencing any exterior building demolition and removal, either a "Demolition-Removal" permit or a "Demolition-Construction" permit must be issued by the City of Fort Collins Building and Zoning Department. Contact the Building and Zoning Department of the City of Fort Collins at 221-6760 and obtain a copy of "Demolition Permits, Policy & Procedures" Memo #59, revised June 15, 1998.

F. Life Cycle Costing (L.C.C.)

1. Life cycle costing is an important analysis used in the selection of systems that generate significant operating costs and/or replacement costs.

   In designs for new buildings and major alterations, life cycle cost analyses shall be performed to assist in the selection of various systems and is required in the A/E's scope of work. An example of an HVAC life cycle cost analysis is provided in Appendix B.

   Cost Elements

   The life cycle cost analysis should use present value calculations.

It is important to note that present value calculations are only meaningful for design decision comparisons. Present value costs should never be used to make budgetary projections of actual costs.

Notations. The following terms are used within present value life cycle cost formula:

FV = future value

PV = present value
TV = today's value

d = real discount rate

e = real growth escalation rate (the differential escalation rate that exists after removing the influence of general inflation)

n = number of years to occurrence or the analysis period, as appropriate

2. Sustainability: Additional considerations to L.C.C. is the material's environmental appropriateness and ecological sensitivity when analyzed on a cradle-to-grave basis.

The complete life-cycle energy, environmental, and waste implications of each building material must be examined. This cradle-to-grave analysis is the tracing of a material or product, and its by-products, from its initial source availability and extraction through refinement, fabrication, treatment and additives, transportation, use, and eventual reuse or disposal. This tracing must include the tabulation of energy consumed and the environmental impacts of each action and material.

- Source of raw ingredients (renewable? sustainable? locally available? nontoxic?) Raw material extraction (energy input? habitat destruction? topsoil erosion? siltation/pollution from runoff?)

- Transportation (most local sources? fuel consumption? air pollution?)

- Processing and/or manufacturing (energy input? air/water/noise pollution? waste generation and disposal?)

- Treatments and additives (use of petrochemicals? exposure to, and disposal of, hazardous materials?)

- Use and operation (energy requirements? longevity of products used? indoor air quality? waste generation?)

- Resources recovery/disposal (potential for recycling/reusing materials? disposal of solid/toxic wastes?)

Selection Priorities

When the source is sustainable:

- Natural materials are less energy-intensive and polluting to produce, and contribute less to indoor air pollution.

- Local materials have a reduced level of energy cost and air pollution associated with their transportation, and can help sustain the local economy.

- Durable materials can save on energy costs for maintenance as well as for the production and installation of replacement products.

In selecting building materials, it is helpful to prioritize them by origin, avoiding materials from nonrenewable sources.

Primary - materials found in nature such as stone, earth, flora (hemp, jute, reed, wool), cotton, and wood

- ensure new lumber is from certified sustainably managed forests or certified naturally felled trees.

- use caution that any associated treatments, additives, or adhesives do not contain toxins or off-gas volatile organic compounds that contribute to indoor air/atmospheric pollution

Secondary - materials made from recycled products such as wood aluminum, cellulose, and plastics

- verify that production of material does not involve high levels of energy, pollution, or waste

- verify functional efficiency and environmental safeness of salvaged (reused) materials and products from old buildings

- look closely at the composition of recycled products, toxins may still be present

- consider cellulose insulation; it is fireproof and provides a greater R-value per inch thickness than fiberglass

- specify aluminum from recycled material; it uses 80% less energy to produce over initial production

- evaluate products containing recycled hydrocarbon-based products; they may help keep used plastics out of landfills but may do little to reduce production and use of plastic from virgin resources

- keep alert for new developments; new environmentally sound materials from recycled goods are coming on the market every week

Tertiary - man-made materials (artificial, synthetic, nonrenewable) having varying degrees of environmental impact such as plywood, plastics, and aluminum

- avoid use of materials and products containing or produced with chlorofluorocarbons or hydrochlorofluorocarbons that deteriorate the ozone layer

- avoid materials that off-gas volatile organic compounds, contributing to indoor air/atmospheric pollution

- minimize use of products made from new aluminum or other materials that are resource disruptive during extraction and a high energy consumer during refinement.

Factors Considered in Choosing Products and Materials	
Energy efficiency	Energy-efficient production methods Energy-efficient use Use of renewable source of energy
Resource responsibility	Minimal need for other materials Lower maintenance, durability Efficient use of resource material Recycled content Recyclable
Social/Public health responsibility	Avoidance of harmful chemicals in production Reduction of off-gassing Avoidance of harmful chemicals in disposal And reuse
Economic/functional responsibility	Cost effectiveness Availability Acceptability
Qualities of supplier on manufacturer	Local resource Local manufacture Local economic benefit In-house environmental programs

II. SITE DEVELOPMENT

A. Professional Competence

All design and/or consulting work for any full or partial site development is to be done by, or under, the supervision of a Landscape Architect, or site planner. City projects need to go through the City Plan process.

B. Site Analysis

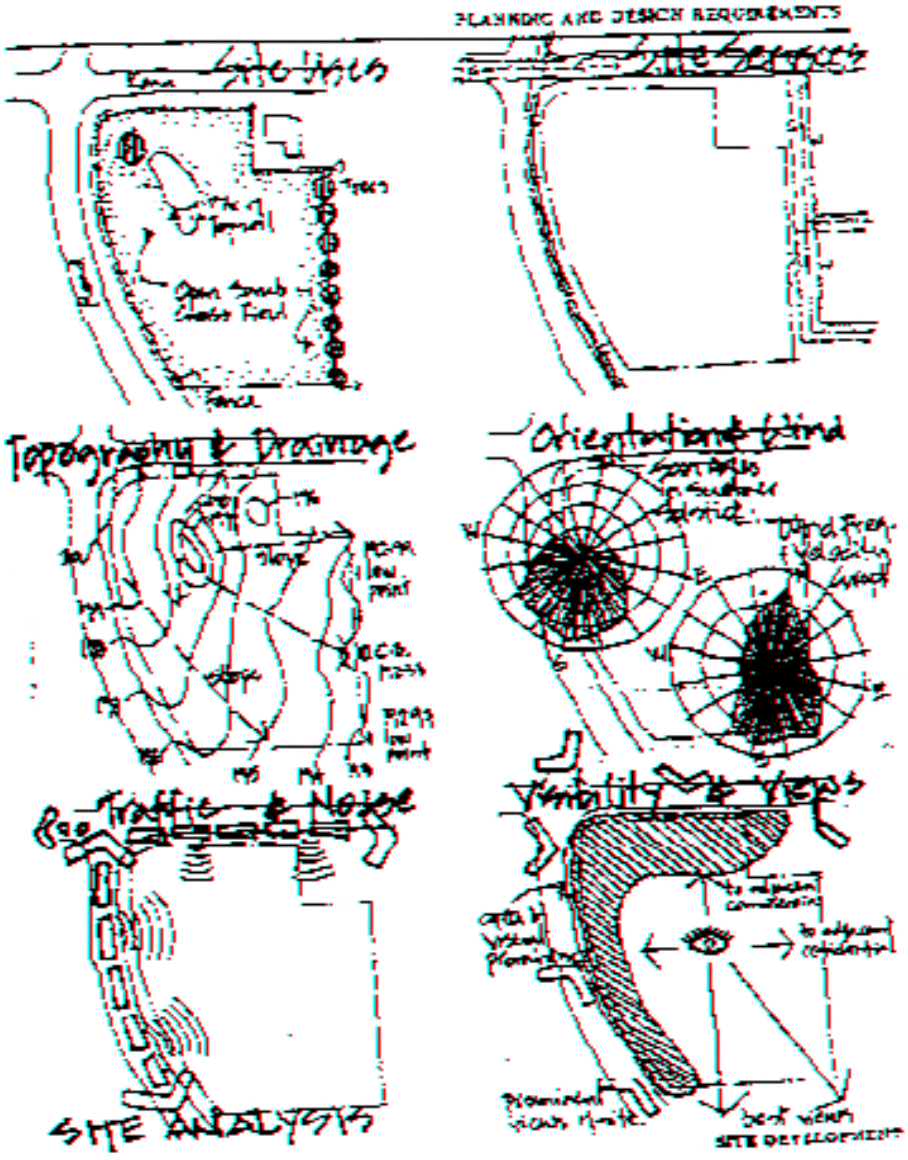
Conduct a study to document all the site factors that physically, environmentally, and aesthetically affect the site. See Figure 1.

The physical aspects of the site analysis should include the following:

1. Climatic information; soils report indicating existing site soils condition for structural foundation design, geologic hazards, flood plain information, topographic and legal survey plan
2. Land use survey of proposed site(s) and adjacent sites
3. Site utilities services information, location, size and capacity
4. Topography
5. Site drainage
6. Orientation
7. Traffic data affecting access to the site with respect to bikes, pedestrians, cars, service vehicles and firefighting equipment
8. Transit routes that service the site
9. Traffic data affecting access to the city traffic network
10. External site noise impacts
11. Visibility views from the site
12. Considerations regarding long term planning impacts with respect to adjacent land development, roads and public transit
13. Recreation areas, i.e. golf course, trails, lake, park, etc.

14. Existing vegetation (trees & shrubs)

15. Wildlife habitat and natural areas



The <u>aesthetic</u> aspects of the site analysis should include the following:

1. A basic understanding of the lay of the land, to determine the site's uniqueness

2. A philosophy on how one would either preserve, enhance, or advantageously use existing conditions

3. A determination whether the site itself has any redeeming qualities that should be retained and/or reinforced - how the community/environment may be used to enhance the site development/building design

4. The identity of natural or man-made elements that may contribute to physical aspects of the site design with respect to orientation, sun and shade, weather protection, energy conservation, drainage, access and approach to the site/building

C. Zoning Requirements

Conduct a study to determine all requirements governing lot coverage, setbacks, height restrictions, land use, etc., and how they may impact long-term considerations with respect to future expansion and alternate uses as applicable.

D. Jurisdictional Requirements

All governing jurisdictional authorities must be contacted and their requirements satisfied in their respective area of input.

E. General Design (See Figure 2.)

1. The general design of the landscaping layout is subject to the approval of the City of Fort Collins Parks and Recreation Department; general site work to follow Storm Drainage Department's standards; and overall design to follow City Plan.

2. The proposed building and its location on the site should present a positive image to the community and the environment. It should present a design image that is compatible with and is sensitive to the requirements of the users and the public alike.

3. The site elements need not be excessively rich in feel and construction.

4. Entry to the building is to be approachable and friendly. It should also relate to the "center of gravity" where the most of users would come from; either pedestrian or vehicular. Design for universal access (ie: disabled as well as able-bodied people).

The entrance to the building should be oriented if possible southward. The entrance should be visible from the public thoroughfare. Provide a point of orientation for persons visiting the building

The building should not present a "back wall" to the neighborhood.

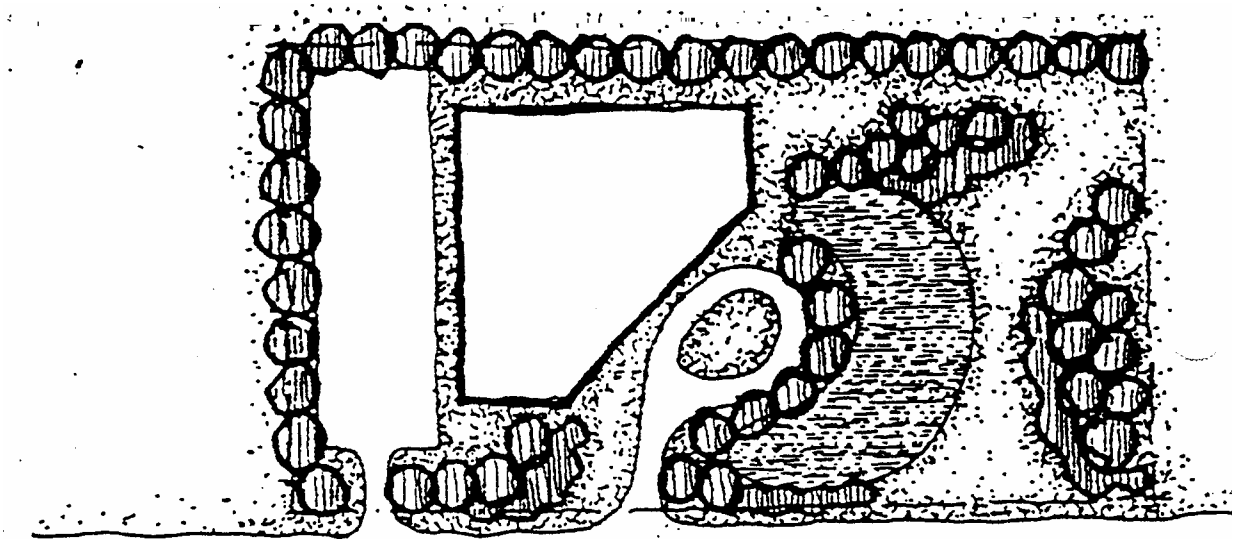
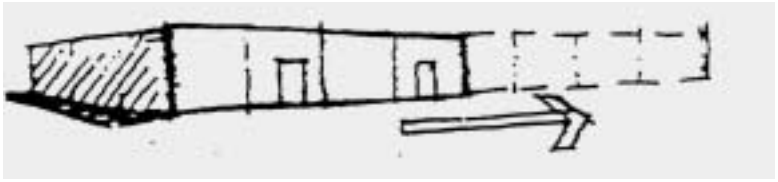


Figure 2

5. Xeriscape landscaping should be incorporated into the site development as a means to conserve water usage and lower maintenance costs.

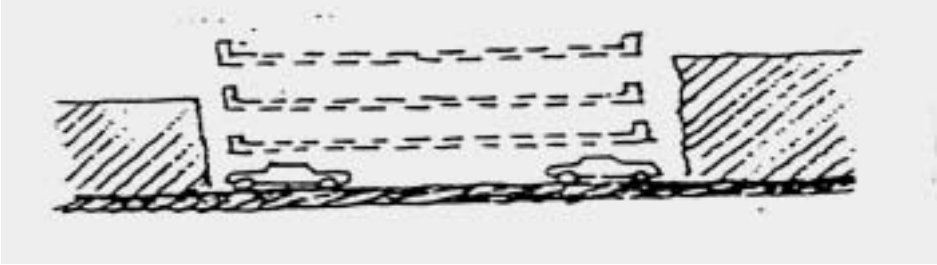
6. Consider future horizontal expansion for buildings such as administration facilities.



Consider vertical expansion of buildings to preserve open space or adjacent buildings. Vertical expansion of buildings tends to be more costly and disruptive to existing building operations than horizontal expansion and requires the provision of adequate structural design, future parking and utilities.

In either case, the site design should accommodate future building expansion with minimal disruption and cost. Location of site utilities should be determined with expansion plans in mind.

Consider conversion of surface parking lots to multi-level parking structures to provide for building expansion when land is scarce and the intensity of new development can off-set the additional costs of the parking structure.



F. Existing Features

1. Preserve existing site features and integrate them with the new site design. This pertains not only to the use of existing trees, shrubs, rock and water, but also includes those elements, vistas, other buildings, outside the property lines which may have influence on the total space composition.

2. Insure preservation of all useful topsoil and the protection of all areas, grades, etc. which should not be interfered with during construction operations.

3. The use of existing trees must depend on their health, life expectancy and risk of damage during construction. Their root systems, and the immediate grade above, should remain undisturbed. If changes of grade are required close to a tree, provide the proper measures for its continued health.

G. Impact on Neighborhood

1. The surrounding neighborhood, if residential, should be buffered from noise and light created by automobiles on the roadways and in the parking lots and roadway/parking lighting.

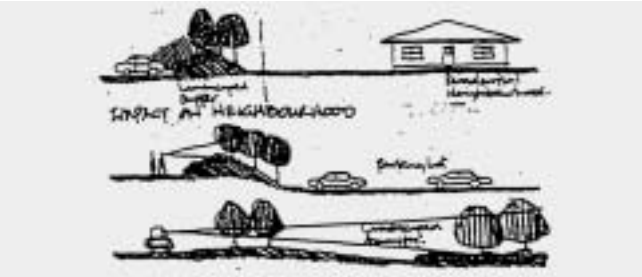
2. Orient service areas away from public view. Develop service traffic routes so as to minimize conflict with automobile traffic.

3. Without reducing the ability of the building to function properly, the site should be developed to emphasize the provision of open space and minimize the intrusion of the building design.

4. Orient the areas of the building which have more potential for visual interest towards the public streets.

5. Use a planted earth berm or a dense evergreen buffer for site edges where visual screening is needed, such as between incompatible facilities and land use areas or between parking areas and a building or street.

6. The development should be compatible with and sensitive to the immediate environment of the site relative to architectural design; scale, bulk, and building height; identify historical character; disposition and orientation of buildings; and visual integrity.



H. Site Layout

1. Design the site layout simultaneously with that of the building to insure optimum compatibility. Take into account all services, and areas scheduled for future building expansion or future connections to other buildings and proposals.

2. Use hard and soft landscaping to create desirable space organization, open and close areas, privacy, enclosure, exposure or emphasis of certain site aspects, views, etc. Coordinate the character and massing of grading, trees, shrubs, site structures, etc. with that of the building and adjacent property.

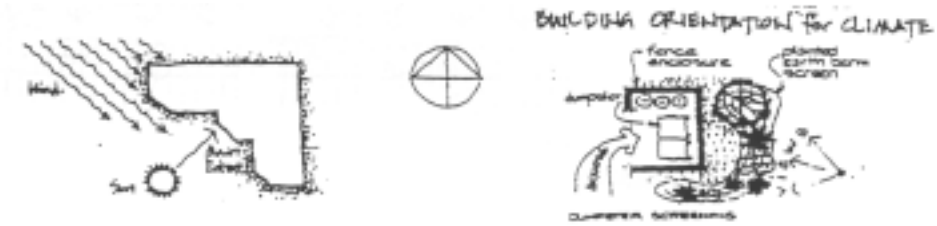
3. Take into account climatic factors, orientation, prevailing winds, snow drifting and the microclimate.

4. Provide proper access and clearances to suit Poudre Fire Authority requirements.

5. The site landscaping should be developed in a manner which will allow visual and active enjoyment by the building personnel.

6. Locate any building loading docks and dumpsters off-street and out-of-sight of main roads and building entrances; employ appropriate fencing and/or planting to screen docks and other areas of low visual interest from public view.

7. Create out-door open spaces between buildings that relate buildings together and convey an appropriate scale, character and quality for their intended use.



I. Site Maintenance

1. Design to assure easy economical maintenance to suit an equipment oriented maintenance program.

2. Arrange grading to insure positive drainage, but avoid steep slopes. If these are inevitable, use a ground cover that reduces maintenance to a minimum. Avoid deep ditches with steep sides.

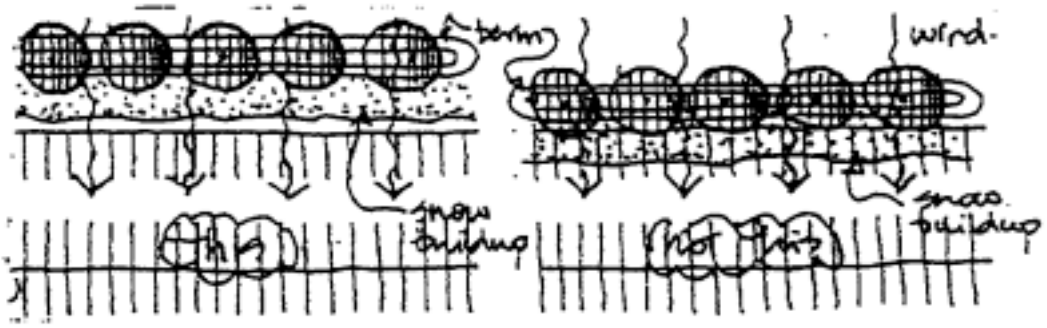
3. Where possible arrange planting, screening, etc. to inhibit snow drifting that may occur across walkways, roads and parking areas.

4. Arrange parking areas to allow maneuvering of snow plows.

5. Allow sufficient room for tractor power mowers, snow removers, etc. to maneuver. Keep grass areas large and simple with no awkward inaccessible corners.

6. Consider the use of mowing strips adjacent to all buildings, fences, etc. Edging must be provided around all plantings and have a weed control blanket underlaying of polyester.

7. Provide adequate watering facilities. Underground sprinkler systems should be used where justified by the design, importance of the project, drought possibilities, etc.



8. Provide proper access for maintenance, repair, and delivery vehicles.

9. If due to site constraints, a building entry is facing north to northwest, provide for an ice melt system at the entry and along routes to the entry.

J. Circulation

1. Pedestrian connections between buildings should be safe, avoiding walkways that cross roads or parking lots.

2. Distance from parking spaces to building entrance should be convenient.
3. Distance from public transit and automobile drop-off points to building entrance should be convenient.

4. The pedestrian routes from drop-off points and parking areas should be sheltered from winter winds by planting or shielding and, if possible, provide protection from rain and snow. Care should be taken not to create a personal security problem.

5. Design the site circulation to provide for:

   a. Pedestrian movement; including the disabled

   b. Visible movement; unloading and parking, convenient roadway access

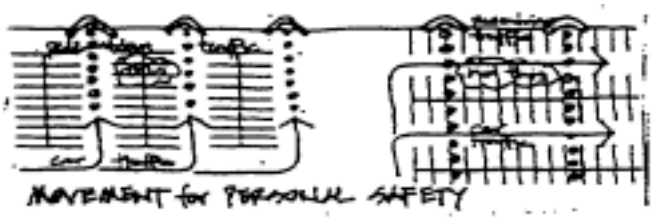
   c. Illumination; using current IES recommendations for average, minimum and uniformity

   d. Service vehicles; convenient roadway access; unloading/loading; turning; and short term visitor parking

e. Bicycles

6. If the site is adjacent to an existing or future public park, public open space, public trail system, or the like, provision should be made to allow public access through the site to these areas, as appropriate and needed.

7. Public transportation: the City encourages the use of public transportation among employees and visitors. The need for a bus stop should be considered early on and discussed with Transportation Services.



K. Roadways

1. Keep the road system for vehicles to a minimum and avoid unnecessary paving of large areas. Provide visitors parking near main entrances, with convenient drop-off zones. Public transportation loading zones should preferably be close to building entrances. Bus traffic, when planned for on the site, should not interfere with peak traffic flow from parking areas.

2. Road construction shall be designed to accommodate heavy vehicles (i.e. service and firefighting) where applicable.

3. Roadways must interface with the adjacent public streets in a manner which will minimize disruption at existing intersections and yet allow for the most efficient exit and entry of building personnel.

4. Locate and develop roadways and parking in such a manner as to facilitate cleaning, snow removal and other associated maintenance and repair operations.

5. Planting of shoulders and medians should be of low maintenance plant materials.

L. Walkways

1. Walkways, including pedestrian ramps, shall be of non-slip concrete, asphalt or interlocking paving stones, minimum 5'-O" wide and 6'-O" wide where mechanical snow removal equipment is to used. Limit] cross slope to 1/4 inch per foot.

2. Provide adequate access for disabled persons to each building.

3. Avoid the use of walkways intended for occasional shipping, receiving or service vehicles. Provide deliberate loading bays or convenient curbside access. Do provide emergency vehicular access where required or directed.

4. Provide ample hard surfacing at building entrances. Consider the use of alternative surfacing such as hard-baked bricks, asphalt, paving blocks, concrete slabs with colored or textured finishes. Surfaces shall stand up to snow removal operations and de-icing agents.

5. Curb ramps shall be designed to avoid cross slopes over 1/4 inch per foot along a walkway. See Appendix C -1.

M. Parking

1. Conform to City zoning requirements/Guidelines.

2. Provide adequate parking for staff, visitors including disabled and service vehicles. Arrange for disabled parking and access aisles to be as close as possible to main entrance of building. Include disabled van accessible parking and access aisles at a rate of 1 for every 8 disabled parking spaces. Comply with ADAAG for disabled parking space sizes and access aisle requirements.

3. Locate parking areas where they will not detract from the aesthetics of the building and landscaping, but will still be easily accessible and functional. The walking distance to the building entrance is governed by the specific uses of the building. As a rule of thumb, limit the walking distance to building entrances to 500'. Up to 780' may be approved in extreme circumstances.

4. Avoid large single parking lots. Use landscaped islands, screen planting and trees. Insure they do not interfere with driver's vision or with snow removal and storage. Locate walks clear of the overhang of cars parked up to curbs. Use hard surfacing under such overhangs.

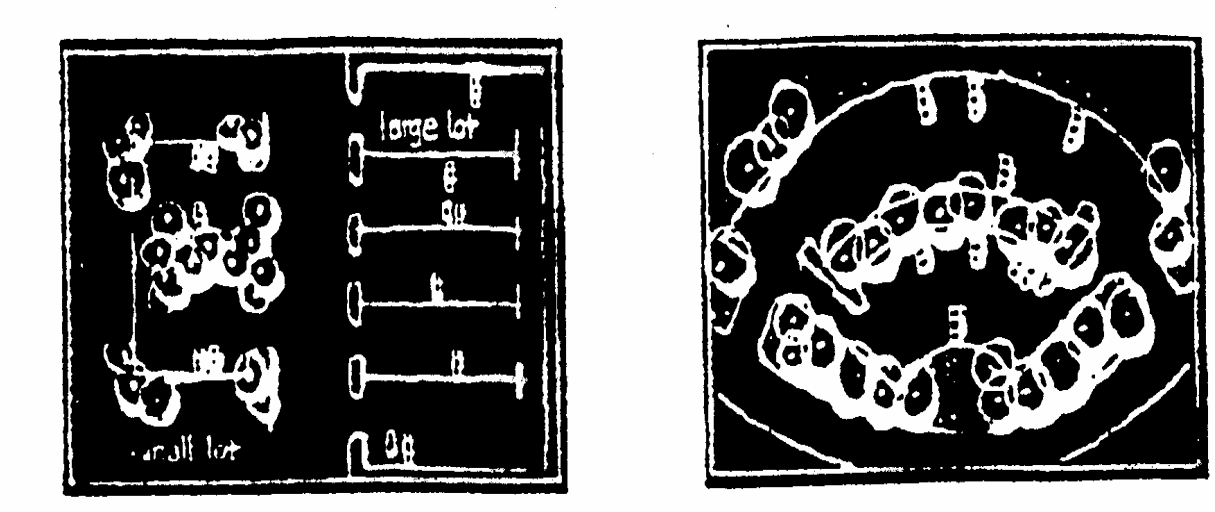
5. Provide service areas large enough to maneuver trucks without excessive pavement. Minimize the need for backing up.

6. The service area should also be isolated visually and physically as much as possible from circulation patterns to minimize impact/traffic crossovers and noise.

7. Small parking lots are usually preferable to large lots, as they enhance the visual environment by increasing the percentage of landscaped area to paved area and allow more conformance to natural topography. The unrelieved monotony of large parking areas may be altered by developing alternative designs, such as curvilinear plans.

8. When islands are used to separate parallel parking bays, the minimum width should be 12' to provide a margin between over hanging bumpers and plants.

9. Earth berms can effectively screen parking lots from street view. Planted earth berms along the perimeter of the lot facing a street should be designed relative to the 52" viewing height, or eye level of a motorist.



N. Snow Clearing

Design for ease of snow removal Incorporate adequate snow storage areas, clear of low planting and graded for good run-off. Locate them, preferably, at one or both ends (not sides) of the parking lot and/or grass-covered islands. Where snow storage space is limited, design lots slightly oversize to allow for temporary snow storage. Artificial mounds should not aggravate snow drifting problems, particularly across walks or paved areas.

O. Grading and Drainage

1. Design finished grades to provide positive drainage of all lawns and paved areas. Allow no drainage of surface water towards buildings, pools, or onto neighboring property.

2. Slope of grass lawns should be between 1-1/2% and 6%.

3. Slopes in excess of 6% are considered berms or hillsides and are to be approved by Parks and Recreation Department.

4. Treat unpaved slopes steeper than 4:1 (25%) with ground cover, riprap, retaining walls or some other means. Grass is not recommended.

5. Consider the design value of grading to enhance visual effects and to achieve economy in the use of on-site material, although this may not be the prime consideration. Try to avoid the need to move large volumes of soil. Grading in the vicinity of existing trees to be retained should be avoided.

6. On-site material may be used to create visual barriers or mounds, acting as screens for the deflection of wind and noise, and for the guiding of traffic in desired directions. Use mounds only if the site is large enough to permit long naturally blending slopes. Round off the tops and bottoms of all slopes to avoid sharp transitions. Do not place material on areas of potential and/or future development.

7. Design for fast drainage of areas where snow will be stockpiled. Direct the drainage towards gutters to minimize the effect of de-icing agents on lawns. Minimize drainage over sidewalks. Avoid the use of culverts.

8. Avoid the use of ditches and flumes. Design swales to handle maximum run-off, allowing for snow build-up but make them as shallow as possible for ease of maintenance. Where depth is excessive, use catch basin.

9. Design swales to have a minimum grade of 1-1/2% with side slopes not in excess of 4:1. Minimum swale depth to be 6". Maximum swale depth is variable, but, in any event, swale depth is not to exceed 20".

10. Design drainage to the naturally lower edge of a parking lot rather than the center of the lot.

P. Retaining Walls

Maintain a realistic cost relationship between foundation and above-ground construction of low retaining walls and walls for planters. Consider alternatives such as dry stone walls, concrete cribbing, treated wood, flat foundation on gravel filled trench. Riprap may be used if compatible with the project. Avoid using small and/or loosely placed members susceptible to being dislocated.

Q. Art in Public Places (APP)

The City has an APP Program. Contact the Director of Cultural, Library, and Recreational Services for specific requirements.

R. Topsoil, Lawns, and Planting

1. Existing site topsoil shall be re-used.

2. Plant material must be from areas with similar climatic conditions to the site. Planting plans should incorporate plant types best suited to the site, and most likely to transplant successfully and giving vigorous growth within the second year following transplant. The use of native container stock is encouraged.

3. Street trees should be located between the sidewalk and buildings, leaving the strip between the sidewalk and curb free for installing and servicing underground utilities. City Forestry office needs to review types of trees proposed.

S. Instant Landscaping

1. This is preferred and is the special use of plant material to achieve an immediate landscaped effect as follows:

   a. By planting trees and shrubs sufficiently large to guarantee quick establishment and vigorous growth. Do not, however, specify trees of such sizes that cost becomes prohibitive and survival doubtful.

   b. By mass-planting of limited varieties.

   c. By close-spacing plants, which can be thinned out later.

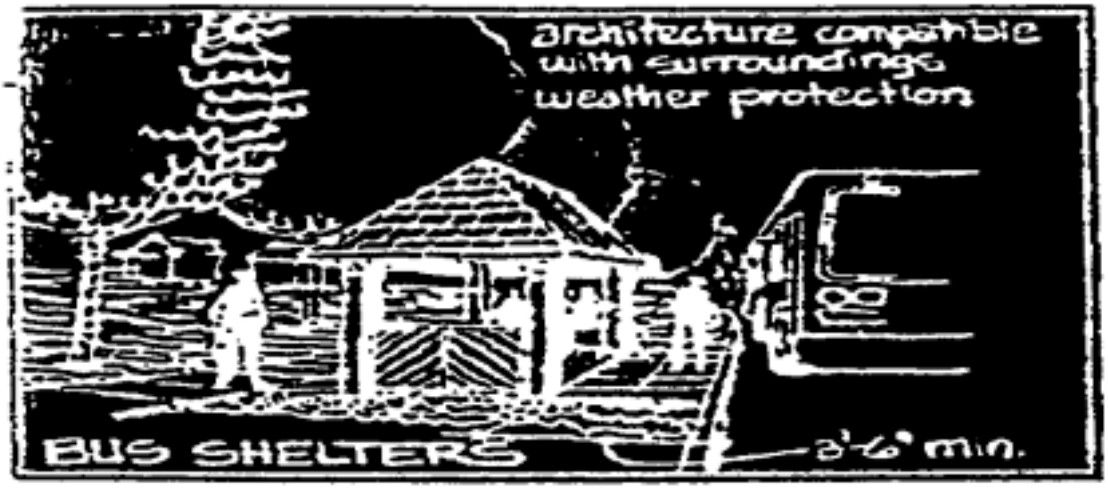
   d. By planting fast growing trees in combination with slower growth more permanent varieties. The faster growing trees may be thinned out or removed in later years when the permanent planting is large enough.

T. Miscellaneous Site Features

1. Design miscellaneous site features to complement the overall site treatment and relate their design and use of material to the building.

a. Site Structures

Coordinate the design, location and elevation of all supporting site structures such as transformers, gas valves, bus shelters, etc., to ensure compatibility with all project features as well as the entire site.



Planters / Seating Walls

These may be included on large paved areas near entrances and in courtyards. Where they form part of a permanent structure, specify sufficient insulation to reduce frost penetration from the sides. Provide positive drainage by means of granular, weeping tiles, drainage holes. The best method would be to provide for a 6" layer of clean gravel and drainage holes. Locate holes to avoid staining walls or pavement and specify a 1/4" layer of fiberglass filter mat to separate gravel and topsoil. Planters should be heavily planted to reduce hand weeding. Specify the application of a water proofing coating.

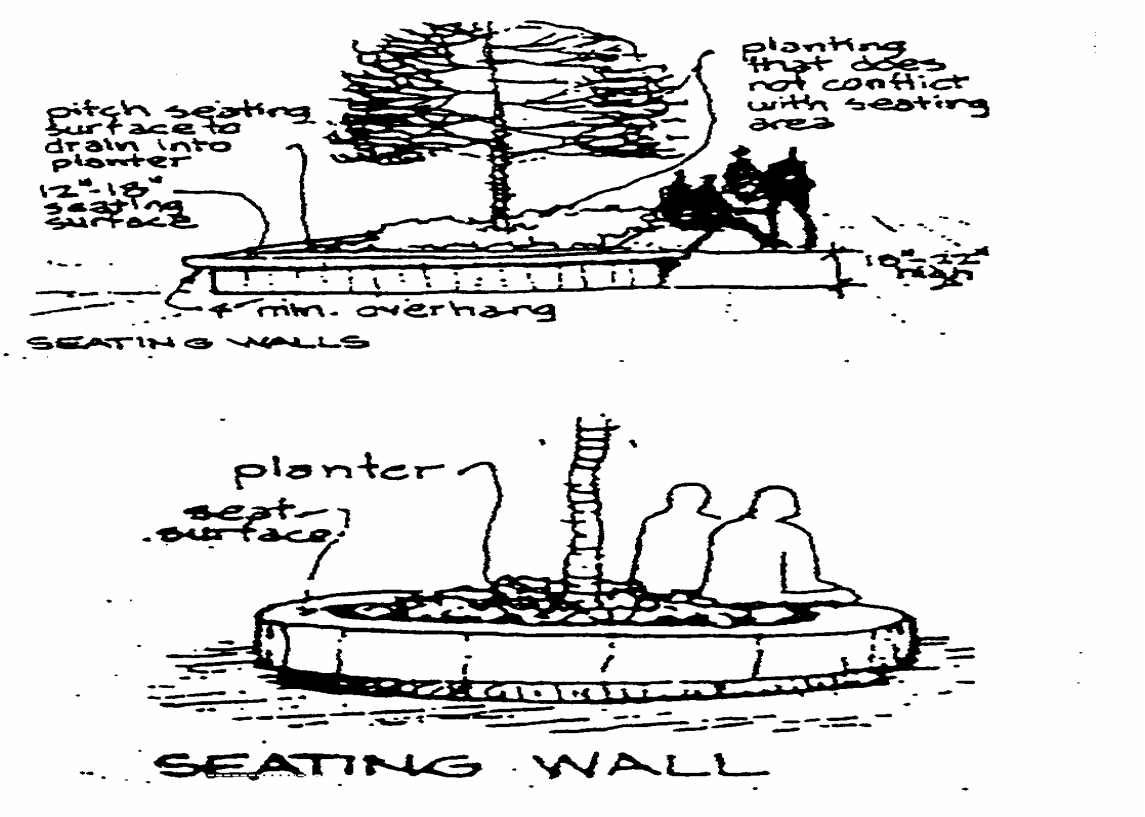
Pitch the seating surface 1/8" per 12" to allow surface water to drain back into the planting bed.

The seating surface should ideally have a 4" overhang from the planter wall for heel space and facilitate rising from a seating position.

Provide 2'-O" for leg space in front of the seat edge to avoid impeding pedestrian traffic.

Use dull and light colored materials for seating surfaces that will be in direct sunlight to keep them cooler. Use dark and shiny surfaces only in shaded locations so they do not become uncomfortably hot in the direct sunlight.

Vegetation near seating walls should not conflict with pedestrians or people sitting; avoid species that are invasive, injurious or that shed excessive or staining debris.



3. Fencing and Walls

a. Coordinate the design of perimeter fencing, walls, site screens, decorative walls, etc. with the general landscaping treatment.

Walls and fencing should be used appropriately for the following functions:

Security
Boundary definition
Visual screening
Wind Screening
Pedestrian and vehicular traffic control
Retaining soil (grade change)
Recreational ball screens (tennis, etc.)

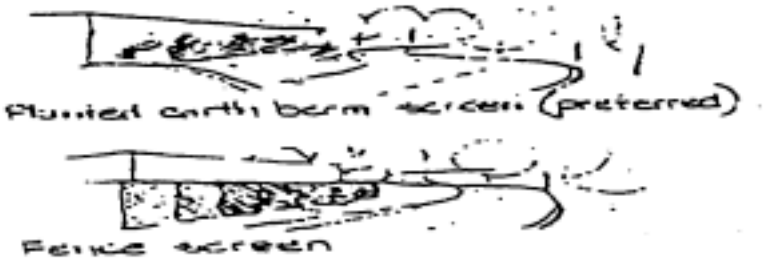
Walls and fencing should be of appropriate design and materials to fulfill their function harmoniously with the character and appearance of their setting.

Chain link type fencing should generally be limited to uses such as security fencing, general boundary fencing or tennis court fencing. All fences shall have an 18" concrete mow strip (9" from fence center-line). City Plan may overrule these requirements.

Wood or masonry walls and fencing are generally the most compatible and harmonious materials for use in residential environments.

Trash containers should be screened effectively with opaque fences or walls of appropriate design and materials compatible with the architectural character and setting.

Earth berms and plant materials are preferable to either walls or fencing when screening parking lots, loading and storage areas, or similar functions from view along main roads.



b. Unless specifically designed for security purposes, fencing should not present any unnecessary dangers for people who might be tempted to climb over.

Support posts should be adequately strong and properly anchored to the ground so that the fence will not collapse under either high winds or the weight of a climber.

The fence material should be well-secured to all posts.

Fencing should be free of all dangerous appendages or projections that would be injurious to persons on an adjacent walkway or play field; all exposed fastening devices and material edges should be rounded off, knuckled or capped to prevent cuts and abrasions.

All slatted fences and railings should avoid horizontal or vertical spacings where children's heads might easily be caught between members.

c. All necessary low wall designs should consider the possibility of incorporating seating surfaces, if appropriate.

Weep holes and wall drains should not drain onto and across walkways where they could create slippery ice spots during the winter months.

4. Benches, Seating and Tables

Locate seating oriented to user needs of waiting and resting adjacent to paved walkways, entry-ways, and plazas, near the tops and bottoms of major stairs and ramps, at bus stops and other locations deemed appropriate by anticipated need and use.

Locate seating oriented to user needs of socializing, relaxing and eating in less formal spaces with a pleasant setting and view that are conducive to their intended purpose.

Seat fronts should be set back 2'-0" from adjacent sidewalks to provide ample leg room and not to impede or obstruct pedestrian traffic.

A space of 4'-0" should be provided at the end of benches to enable strollers and wheelchairs to be parked.

A space of 5'-0" should be provided between the front edge of the seat and any stationary obstacle such as a water fountain, trash receptacle or sign post.

Especially where longer-term sitting occurs, seats should be designed with back supports, contoured seats and arm rests for comfort in sitting and support in getting up and down from the seat.

Seat height should be 18"-20" from the ground and be uniform and level.

Seat depth should be 12" minimum to 18" maximum (16" ideal) and be pitched back at an angle of 0-5 degrees to the horizon.

Seat width should be 24" per person.

Back rests should be 15"-18" high (16" ideal and at an angle of 90-110 degrees to the seat (105 degrees ideal).

Arm rests should be 6" high from the seat and be a minimum width of 1 ½".

The seat should overhang the support legs by a minimum of 4" to provide heel space and to facilitate rising from a seating position.

Seat surfaces should be pitched or slotted to shed water. Seats should be constructed to support a minimum of 250 pounds for each person they are designed to accommodate.

Seat surfaces should be smooth and constructed of materials that do not tend to either retain heat or cold, or splinter. The recommended wood seating surface is Redwood. Recycled plastic/vinyl products also should be considered.

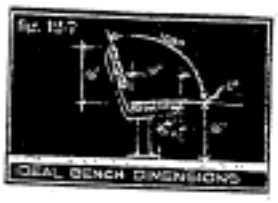
Seats should have no sharp edges or protruding hardware.

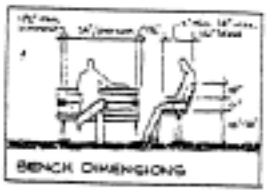
All wood should be non-splintering and have rounded edges.

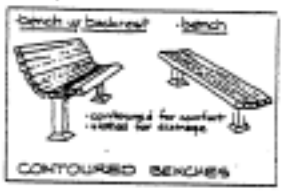
All metal should have rounded edges and be rustproof.

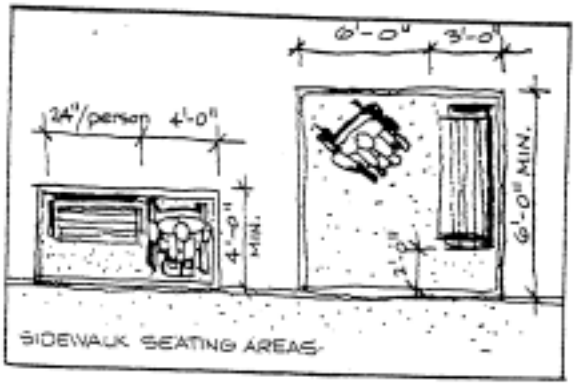
All mounting hardware should be concealed, recessed and/or plugged.

Seating in areas subject to vandalism should be selected with care for firm anchoring to the ground and durable materials.









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5. Signage

The goal of a well designed site should be to use as few signs as possible. Follow City's standards and:

- Provide signs only where a need exists.
- Ensure that the placement of signs relate to their function.
- Provide signs that are visible and designed to attract viewer's attention.
- Provide signs that are harmonious with their architectural and natural setting.
- Ensure that all signs are legible.
- Provide a hierarchy of information that conveys information in the sequence most beneficial to the viewer.
- Conform to the ADAAG sign requirements for persons with disabilities.
- Facilitate changes or incremental additions and deletions to the sign as need arises.
- Consider a sans-serif type style of lettering such as Helvetica medium as it is easily read.
- Building address signage shall conform to Poudre Fire Authority standards.

6. Outdoor Lighting

Provide outdoor lighting at strategic points, near entrance steps, walkways, loading ways, parking areas, and at those locations where regular evening traffic can be expected. Lighting adjacent to a residential zoned area should be shielded from that area.

7. Flagpoles (If designated or required)

Location: Flagpoles must be located in prominent positions clearly visible to the public and generally related to the main entrance - at grade or attached to the face of the building directly above or near the main entrance. Lighting of the flag should be included in the design.

8. Special Features

Any special design features such as fountains, pools, elaborate courtyards, etc., require justification in terms of the project size, importance, prestige value, location and use, etc.

III. BUILDING DEVELOPMENT

A. Design Principles

1. The City of Fort Collins expects the architect to maintain a high standard of architectural design, based upon recognition of contemporary design principles. All design elements; planning, architectural, engineering, and landscaping must be fully coordinated, and consistent in adherence to good design principles. The design should be based upon quality environmentally sensitive materials to provide a facility having a useful life of 40 years or longer.

2. All primary entrances, that are required to be ADAAG accessible shall have automatic doors.

3. Design strictly within the budget and in accordance with sound investment economics and operating/maintenance expenditures.

4. Design for the optimum ratio of net useable space to buildings gross areas with a minimum being 75%.

5. Design for future expansion as determined by the project program statement such that permanent built-in space functions such as service rooms, duct spaces, etc., are sized and located for ease of future additional capacity and construction.

6. Quality of materials and construction methods shall be commensurate with the type of building and the budget. Avoid experimental materials. Take into account the total life cycle of the building. Use renewable, indigenous building materials to the greatest extent possible. Use cradle-to-grave analysis in decision making for material selection and construction techniques.

7. The City expects imaginative design and good aesthetic expression throughout all projects. Design shall be compatible with adjacent buildings, or with the existing building in extension work.

8. The overall philosophy of the building design should be trend setting in compliance with the latest general aims of the City.

9. It is the City's goal to build buildings that accommodates the latest advances in office technology and communication. Flexibility to accommodate the future evolution of technology is necessary.

Making this concept a reality requires comprehensive design for architectural and engineering systems. In the interest of building system integration, it is mandatory to develop the design work of all disciplines simultaneously with the architectural concept rather than retrofitting engineering systems into a solidified architectural design.

10. Use of raised Access Floor Delivery of power and communication lines is highly desirable to maintain flexibility in modifying office areas. Minimum of 2 inches. See Appendix D.

11. Where possible and practical, designed space functions should be adaptable and flexible for alternative uses or multi-purpose functions in order that maximum usage may be derived from those spaces.

12. All entrance areas require an entry removable mat and drainage system to prevent the tracking of dirt, melting snow and rain water into the building.

13. Entrance lobbies have high levels of visibility and public use, this warrant the highest degree of visual detail and finish.

14. Design lighting levels for the projected area use. Indirect lighting with floor to ceiling heights of 10 feet should be considered in Administrative spaces.

15. Indoor Air Quality follow ASHRAE standard 62 "Ventilation for Acceptable Indoor Air Quality" to provide good indoor air quality. Check the "Indoor Air Quality" prior to moving into the facility. Use of Indoor Air Quality sensors tied in with the HVAC control system are to be considered in extreme use areas (I.E. community rooms, council room, training rooms).

16. Provide restroom facilities, particularly women's, commensurate with the building's function (i.e., a performing arts facility would have a high usage over a short time (intermission) thus would need more stalls/urinals than normal design standards). Floors shall be sloped to the floor drains.

17. The City requires that the drawings be done in AutoCAD format. The A & E will provide the City a disk(s) containing "Facility Record Management Record Drawings" as delineated on page 44 of the CAD LAYER GUIDELINE (1990) published by the AIA

18. Custodial spaces - see Appendix F for requirements.

B. Building Code Requirements

Prior to the commencement of concept design, a review and understanding of all City building code requirements as they are applicable to the type of building being designed is desirable so as to prevent future designations and restrictions as they may develop through further development of the project.

C. Natural Light and Outdoor Awareness

The provision of fenestration and skylights to allow the penetration of natural light into interior spaces and the creation of exterior views is a mandatory requirement for quality of space values when inhabited by visitors or working people. In addition, exterior views will allow visitors and users a greater perception of outdoor awareness for the purposes of orientation with respect to the interior and a means of visual relief. Natural light and exterior views would be required for most areas. Direct sunlight penetrating the interior space should be avoided. Coordination between the electric lighting system and the daylight system should create brightness rations no greater than 5:1.

D. Circulation and Functional Orientation

1. The system of public movement in the building should encourage the use of the building and penetration into its areas. Provide the public with access to and activity on various levels of the building to permit familiar and routine use of the entire building.

2. The ground plane should be the principal level of public activity and all other levels and systems of circulation should be related to it. The public circulation system should be a fine grain extension of the principal public space and should structure the building in a clear and comprehensible manner. Where possible, it should refer the user back to the ground plane and/or the lobby by means of selective views.

3. For areas requiring a high degree of public accessibility, the design of the circulation space should provide some visibility from the main circulation spine or ground plane.

4. The public image of the building will be determined to a large degree by the characteristics of the circulation system. The quality of the space, the ease of orientation, the availability of locational cues all contribute to the impression of the visitor. As a public oriented building, the circulation system must also take into account the requirements of disabled persons.

E. Fine Art Focus

For the benefit of a facilities user, visitors and the public at large, a focal point in the building should be created whereby art or public information displays, temporary or permanent, may be erected.

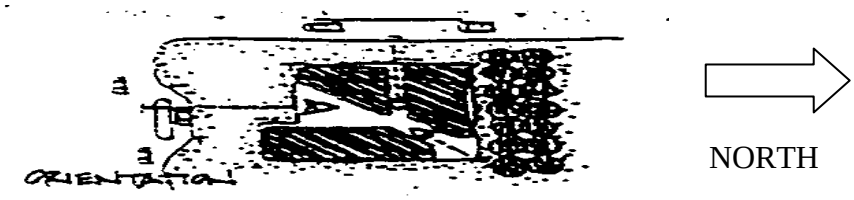
F. Orientation

1. Take advantage of natural light, heat gain and minimizing exposure to northerly winter winds.

2. Allow the indirect penetration of sunlight into the inner spaces by possible means of atriums and skylights.

3. Design wall systems to maximize the impact of natural energy conservation measures along southerly and westerly facing perimeter areas through concepts as overhangs/sun shades to minimize and maximize heat gain at various seasons.

4. Keep glazed areas to a minimum in pools, ice rinks and other high humidity areas. Use insulating glass and framing systems with thermal breaks.



5. Locate structures to take advantage of passive energy technologies for human comfort.

6. Energy efficiency related to site, architecture, electrical and mechanical systems should be considered during programming and conceptual design for the project, especially the site and architecture. The conceptual site planning and architectural design can dramatically reduce the energy loads, providing more opportunities for the electrical and mechanical systems.

   The key energy loads and operating costs that can be responded to in the site planning and building design are heating, cooling, and lighting. Through proper site layout, architectural form, orientation, and building envelope characteristics, the thermal loads can be reduced substantially over a typical building that meets current energy codes and standards of practice. In other words, through design, the building will gain little solar heat in the summer, appropriate amounts of solar heat in the winter, and receive daylight throughout the year.

Daylighting strategies are suitable and cost effective techniques. Daylighting--the use of natural light to effectively reduce electric lighting requirements--can improve the visual quality of the interior environment and lower operating costs. The energy use and cost is reduced not only for the electric lighting, but cooling needs are reduced too, since there is less heat given off with daylight than with electric light. Further, daylighting often works best at times of summer peak demands and therefore reduces the demand and use charges. Proper daylighting includes solar control, a benefit for both cooling and heating as well.

The common architectural "form givers" for daylighting are building form or geometry, sun control, surfaces, and glazing strategies. The architectural treatment of the facades should vary as it relates to different orientations. For example, the south and north orientations are going to be the best overall performers. The north should be relatively unobstructed to achieve a good exposure for a relatively stable, cool color north light. The south should have controls through landscape and/or architectural features (i.e. overhangs, light shelves, etc.) To best respond to year around conditions. This is relatively easy to do on the south. The southern orientation gives the most amount of daylight so that a little bit of glazing goes a long way. Deeper effective lighting can be achieved, but is must be controlled.

The east and west orientations are the least effective for daylighting and the most difficult to control due to the low sun angles throughout the year. Again, the size and type of glazing, along with control strategies, are important to achieve comfort conditions and use daylight when desirable. This can be done through landscape, architectural features, and glazing characteristics, each of which should be different than southern and northern exposures.

G. Security

1. The design of the proposed facilities must achieve a balance between a desired image of openness and a necessary degree of security. It should be possible to maintain security without excessive reliance upon locked doors. Use proximity card readers for controlled access. The Security philosophy is to have access control on all parameter entrances minimally, with Department areas as a second level of access control if funds available. Integrated into this is use of the city primus key hierarchy on all exterior doors, with Department areas that are on access control also having primus cylinders on entry doors.

2. Light walkways and parking areas through the night hours so as not to create any personal security problems. Follow IES current standards for average, minimum and uniformity illuminance levels.

3. Design Facilities so as to not create hidden corners, overhangs or visual black holes that may invite surreptitious behavior or vandalism.

4. A minimum number of doors opening to the exterior should be provided in order to preclude forced entry. Exterior doors should be readily visible.

H. Engineering

1. General Engineering Design Approach:
Each of the Engineering disciplines involved in designing structural, mechanical and electrical services for the City of Fort Collins buildings and/or site services should approach the design in the following overall manner.

a. Attend the City's project pre-design briefing and receive requirements, design philosophy and parameters to followed. They should understand the purpose, usage goals of the building and the people who will occupy structure.

b. Each discipline shall study the design criteria provided at the initial and subsequent meetings and as presented here for full consideration as a general approach. Generally, principles of design shall;

1) meet the performance requirements with the least life cycle costing;

2) be designed to use a minimum amount of energy consistent with required performance standards;

3) include safety to personnel during operation and maintenance;

4) have ease of maintaining equipment and the facility itself;

5) have flexibility and reliability; and shall

6) comply with all applicable Codes and Standards.

c. Together with the preliminary design drawings and specifications each discipline shall submit preliminary cost estimates for their portion of the work outlined. As the cost changes during the design and working drawings, the Architect and Engineer shall inform the City of these changes in writing stating the reason for the change.

d. When the City has studied and approved a preliminary design, the Architect and Engineer shall proceed with the final design and contract documents.

e. Working drawings shall be prepared on Mylar film with separate systems on separate drawings. Submit drawings at end of preliminary design and at 95% review and at 100%.

f. Specify “As-Built" Mylar drawings reflecting all field and change order changes, Operation Manuals, and equipment operating procedures to be provided by the Contractor.

g. Specifications shall be prepared with the same format as outlined for the architectural work. All equipment specified shall consist of at least three equivalent manufacturer's products with full catalogue numbers, ratings and full description to allow a clear understanding of what is required.
Alternate products should be allowed to be proposed stating a money difference but not carried in the base bid. Equivalent products requirement does not apply for specific items denoted in Section IV. (Specifications)

h. Construction administration or review by each discipline shall be as spelled out in the Architect and Engineer/City contracts.
This should list the responsibility undertaken, frequency of visits, report writing, changes to the contract, etc.

I. Computer-aided drawing is required (AUTO-CAD or compatible). The City requires an AUTO-CAD compatible copy of the facility floor plan(s).

I. Structural Systems

1. General Approach

a. During the life span of a typical City building, many minor and major alterations are necessary as the missions of department change. The capability to accommodate alterations must be incorporated into the building from the outset. In some cases structural systems should be designed to provide some leeway for increase in load concentrations in the future. They should be designed to facilitate future alterations, e.g., the cutting of openings for new vertical elements, such as piping, conduit and ductwork.

b. The structural framing system should combine economy with a minimum overall story height. Preferred systems enable services to run within the depth of the framing.

c. Multiple story buildings should be designed to eliminate all floor vibration.

2. Future Expansion

Perimeter building elements should be designed and detailed to facilitate future building expansion when this is required. When it is possible at the design stage to define the direction of future expansion, only those elements that will be affected by the expansion need be proportioned to facilitate the expansion.

J. Roofs

1. Roofing design should follow the recommendations of the National Roofing Contractors Association as contained in NRCA publication, NRCA Roofing and Waterproofing Manual. The design of metal flashing, trim, and roofing should follow the recommendations of the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) publication, Architectural Sheet Metal Manual.

2. *Roof Drainage*. Dead level roofs are not permitted. Roof drains or scuppers are the only low points permitted. Provide a minimum slope to drains of 1/4" per foot.

3. *Access to Roof*. An interior permanent stair would be first priority to access the roof, the second priority would be stairs with no less than 45° slope with handrails.

4. *Roof-Mounted Equipment.* Roof-mounted equipment should be keep to a minimum and must be housed in penthouses or screened by walls. Penthouses and screen walls should be integrated into the building design and constructed of materials used elsewhere in the building exterior. Some roof-mounted equipment, such as antennae, lighting rods, flagpoles, etc., does not have to be screened, but these elements must be integrated into the building design.

K. Acoustics

The design must consider the acoustical environment as a whole; integrating ceilings, masking sound, furniture, panels, and carpeting to obtain optimum acoustical privacy. For open offices the following guidelines apply:

1. Ceilings - should have a noise reduction co-efficiently (NRC) of.85 or higher; have articulation class (AC) rating from 180 to 200; a Ceiling Attenuation Class (CAC) minimum of 35 and a minimum Light Reflectance (LR) of .83.

2. Partitions - should have a Sound Transmission Class (STC) rating of 20 or higher; have a NRC of .70 or higher; and a speech frequency sound absorption average of .80 or greater. Recommended height of partitions is 65 inches.

3. Walls - have NRC of .80 or higher.

4. Carpeting - have a NRC of .30 or higher.

5. Sound Masking System - use to bring ambient noise level to 40 to 45 decibels, as necessary.

L. General Mechanical System Design

1. Principles of Design:

a. Use the latest available, proven technologies to provide energy efficient and cost effective heating, cooling, lighting, and hot water. Use the most current solar heating technologies for hot water heating that are suitable for the facility. Select systems based on consideration for maintenance, operation and availability of spare parts. System and equipment shall be failsafe and of a quality consistent with anticipated building life.

b. Consideration must be given to expansion, contraction and vibration control. Floating isolation floors or pads under the mechanical equipment are recommended for all major mechanical rooms.

c. Design separate HVAC systems to serve areas expected to operate on widely differing operating schedules or design conditions. Use CO_2 sensors to control outside air in spaces of high occupant load. Separate systems are also recommended for buildings where perimeter zones have heating and/or cooling loads very different from interior zones. When a single system serves a large floor, provisions should be made to shut off or set-back the heating and cooling to each area independently. Telecom and computer rooms to have controlled HVAC for ambient conditions.

d. Large air handling units serving multiple floors are not practical for buildings with scattered loads after normal office hours. Consider multiple air handlers or floor by floor systems. Where practical, a cooling/heating loop dedicated to operation after hours should be considered.

e. Spaces with relatively constant and weather-independent loads should be served with systems separate from those serving perimeter spaces. Areas with special temperature or humidity requirements, such as telecom and computer rooms should be served by separate supplementary or auxiliary systems.

f. The supply of zone cooling and heating shall be sequenced to prevent the simultaneous operation of heating and cooling systems for the same space. Where sequencing is not possible due to ventilation or air circulation requirements, air quantities should be reduced as much as possible before reheating, re-cooling, or mixing hot and cold air streams.

g. Supply air temperature should be reset to extend economizer operations and to reduce reheating, cooling or mixing.

h. Adjustable frequency drives/variable speed drivers permit optimum operation on fan and pump systems. These shall be used whenever possible.

I. An HVAC System Commissioning will be conducted and should follow the current ASHRAE Guidelines 1 on commissioning. In new construction, commissioning will follow sustainable design requirements and be completed by a third party.

j. Duct detectors for fire shall be installed as needed.

2. Cooling Systems

a. Chilled Water Systems

Chilled water systems include chillers, chilled water pumps, piping and cooling towers.

Select the chilled water temperature differential to minimize life cycle cost of the system. Larger temperature differentials will reduce pumping and piping costs but may increase coil sizes.

Specify Chillers in accordance with Air-conditioning and Refrigeration Institute (ARI) ratings procedures in ASHREA/IES 90.1.

Microprocessor-based controls shall be used. They shall have self-diagnostic capability, set point displays, run time, and output/input (COP) information.

All chiller systems must consist of multiple machines. Generally, machines should be of equal size and be controlled via the lead-lag control method. No single machine should run for more than 160 consecutive hours.

Environmental Protection. The design of refrigeration machines must comply with Clean Air Act amendment Title VI: Stratospheric Ozone Protection.

Refrigeration machines must be equipped with isolation valves, fittings and service apertures as appropriate for refrigerant recovery during servicing and repair. Protection systems including low electrical voltage or loss of one phase shall be provided. Chillers must also be easily accessible for internal inspections and cleaning.

Design mechanical equipment rooms in accordance with the requirements of ASHRAE Standard 1..5, Safety Code for Mechanical Refrigeration

Connect chiller leak detection and remote alarming to the building automation system if installed.

Chilled Water Pumps: Select pumps to operate at 1750 RPM. Both partial load and full load must fall on the pump curve. The number of primary chilled water pumps should correspond to the number of chillers, and a separate pump should be designed for each condenser water circuit.

Piping. Reverse return piping is appropriate for systems with many terminal units of similar pressure drop. Direct-return piping system should be used where non-uniform pressure drops through equipment must be accommodated. For all systems, proper consideration must be given to location of balancing valves.

Freeze Protection. Propylene glycol is typically used for freeze protections, primarily in low temperature chilled water systems. Keep the concentration of antifreeze to a practical minimum because of its adverse effect on heat exchange efficiency and pump life. Cooling coil heat transfer de-rating can be about two to three times that of chillers.

Condenser Water. Condenser water circuits must always be recalculating systems. Once-through applications using domestic water are not permitted.

Water Treatment. Water chemistry may cause corrosion and/or scaling in recalculating systems, such as chillers, condensers and

hot water systems. A complete water analysis is essential to the proper design of corrective measures. Since improper addition of chemicals to make-up water is likely to be more harmful than leaving the water untreated, water treatment for all hydronic systems should be designed by a qualified specialist.

Cooling Towers. Cooling water sizes should be based on the 1 percent column of the wet bulb temperature of ASHRAE weather data. Multiple cell towers and isolated basins are required to facilitated operations and maintenance. Piping should be manifolded to allow for any combination of equipment use. Cooling towers should have ladders and platforms for ease of inspections and replacement of components.

Consider dual speed fans. Induced draft is preferred since forced draft uses twice the amount of energy and requires multiple fan arrangement towers run continuously to avoid short circuiting. Induced draft towers must have a clear distance equal to the height of the tower on the air intake side)s) to keep air velocity low. Forced draft towers require a clearance of twice the tower width on the intake side(s) to minimize air recirculation. Clean-outs for sediment removal and flushing from basin and piping should be provided.

Place cooling towers on the site so as not to interfere with the appearance of the building. Screen walls and planting may be used to conceal the tower. Locate cooling towers to prevent drift or plume fogging on the building or surrounding building. If located on the ground they should be kept away from any building wall or parking lot to prevent corrosion of finishes. The effect of start/stop noise and radiated noise on occupied spaces in the vicinity must also be considered. Start/stop noise can be mitigated by specifying A/C invertors.

Install cooling towers having corrosion resistant materials.

If the cooling tower is located on the building structure, provide vibration and sound isolation. Design supports to permit re-roofing under the tower.

Give special consideration to deicing cooling towers if they are to operate in sub-freezing weather. Provide a manual shut-down for the fan. If cooling towers operate intermittently during sub-freezing weather, make provisions for draining all piping during periods of shut-down. For this purpose indoor drain down basins are preferred to heated wet basins at the cooling water.

b. Special Cooling Applications

Water-side Economizer Cycle. In certain climate conditions cooling towers are capable of producing condenser water cold enough to cool the chilled water system without chiller operation. Consider this option in life cycle cost comparisons of water cooled chillers.
Computer Room Air-Conditioning Units. Mainframe computer rooms may be cooled by self-contained units for loads up to 280 kW. They should be sized to allow for 50 percent redundancy, either two units at 75 percent load or three units at 50 percent.

For loads above 280kW, chilled water air handling systems shall be used. A group of dedicated chillers is preferred, unless other parts of the building also require 24-hour cooling. It should consist of three chillers, each capable of handling 50 percent of the sensible load. Connections should be available for the future addition of a fourth unit.

Heat rejection should be of recalculating type, such as cooling towers or evaporative condensers. Use of once-through domestic water is prohibited.

3. Air Distribution Systems

a. Constant Volume Systems

Single Zone Systems. Single zones air handlers may be considered for systems with relatively constant loading.

Multi-zone Systems. Multi-zone systems should be considered for small buildings. Multi-zone units should be of the three deck type to minimize reheat.

Reheat. Reheat permits close control of temperature and moisture levels but it is a high energy consumer. Its use should therefore be limited to computer rooms or similar spaces.

Dual Duct Systems. Conventional dual duct systems use high reheat and thus are high energy consumer and should not be used. Where dual duct designs are used, two supply fans, one for the hot deck and one for the cold deck, are recommended. The design should allow all return air to pass through the hot deck where it recovers heat from internal loads for heating. The heating coil should operate only when additional heat is required. Outside air should pass through the cold deck. This configuration limits energy consumption for both heating and cooling, while maintaining excellent temperature and humidity control.

b. Variable Air Volume (VAV) Systems

Simple VAV without reheat should be considered for interior zones of office buildings that require year-round cooling.

Perimeter Zones. Designers are encouraged to consider the use of an entirely separate perimeter system, which may be central air or water type.

Volume Control. VAV systems depend on volume modulation to achieve the required ventilation and temperature, which makes volume control critical to the successful operation of the system. Rooms loads must be calculated accurately to avoid excessive throttling of air flow due to oversized fans and terminal units. Diffusers should be high entrainment type (3:1 minimum) to maximize air velocity at low flow rates. Also, the minimum volume setting should equal the larger of the following a) 30 percent of the peak supply volume. VAV terminal units must never be shut down to zero when the system is operating. Also the fresh air requirements must be maintained under minimum flow conditions.

In building where simultaneous heating and cooling are required (heating in some zones and cooling in others), two separate systems should be considered.

Terminals. VAV terminals should be pressure dependant unless there is a compelling reason to use pressure independent units.

Terminal ceiling diffusers or booted-plenum slots should be specifically designed for VAV air distribution.

Noise Control in VAV Systems. System sound levels need to be checked at maximum flow. Inlet vanes and fan discharge dampers should be evaluated for noise in their most restricted position. Duct noise control should be achieved by controlling air velocity and by the use of sound attenuators not by over sizing terminal units.

Mixing Boxes. Mixing dampers should be placed across the full width of the air handling unit. Thorough mixing of outdoor and return air is essential for good coil performance and to prevent chilled water coils from freezing.

Filtration. Air filtration should be provided in every air handling system. The air handling unit should have a disposable pre-filter and a final filter. Filter media should be rated in accordance with ASHRAE 52. Pre-filters should be 30 percent to 35 percent efficient. Final filters should be 80 percent of 85 percent efficient and housed in a factory fabricated frame with a maximum bypass leakage of 0.5 percent.

The filter change-out pressure drop, not the initial clean filter rating, must be used in determining fan pressure requirements. Differential pressure gauges should be placed across filter banks to allow quick and accurate assessment of filter dust loading as reflected by air loss through the filter.

Cooling Coils. The preferred configuration consists of no more than six row coils with fins spacing to allow for easy coil cleaning.

If a higher cooling performance is required, a second cooling coil should be installed. The two coils can be piped in series making them in effect one coil that is easier to clean.

Heating Coils. As with cooling coils, heating coils with fins spaced for easy coil cleaning are preferred.

Humidification. Humidification should be limited to building areas requiring special conditions. General office space should not be humidified unless severe winter conditions are likely to cause indoor humidity to fall below 25 percent. Where humidification is provided, vapor barriers should be provided and the dew point of walls and windows must be documented.

Supply Air Fans. Vane-axial fans are preferred.

All fans should be isolated. Thrust arresters should be designed for horizontal discharge fans operating at high static pressure.

An air-side economizer cycle should be provided if feasible.

Enthalpy economizer controls are not recommended because they drift out of calibration easily and may cause energy use to increase. Dry bulb sensors are recommended for use in this area. Economizer cycles should not be used for humidified spaces because of the increased difficulty of maintaining space humidification and control.

4. Special Systems

a. Heat Recovery

Heat Reclaim Chillers. Consider heat recovery chillers for buildings that will require cooling year round. If used in conjunction with air-side economizer cycles, a careful controls design is required to present the two approaches from working against each other.

Heat Exchangers. The condenser water system or a separate 24-hour critical load system can be connected via heat exchange to the hot water heating system.

b. Solar Heating and Cooling

For each new project, consider renewable energy sources for heating, cooling and domestic hot water heating. If cost effective, use renewable sources (solar energy, wind, water).

5. Layout of Mechanical Spaces

a. Generally locate mechanical equipment within the building in an enclosed mechanical room (s). Room shall be of sufficient size to accommodate all equipment (present and future) and with sufficient clearances to permit servicing and replacement of all components. All equipment must have isolating valves, unions for removal and service; thermometers; pressure gauges liquid filled where applicable; valved bypasses to be provided on all control devices. All mechanical rooms to have floor drains to accommodate condensate drainage from equipment. Where maintenance requires lifting of heavy parts, hoists should be installed.

b. Lighting. Lighting in equipment rooms should be laid out so as not to interfere with equipment.

c. Housekeeping Pads. Housekeeping pads should be at least 3 inches larger than the mounted equipment on all sides.

d. Piping. Layout piping in an orderly fashion. Access to the underside of the structure should not be completely cut off.

e. Ductwork. Layout ductwork with a minimum of bends. Access to piping and the underside of the structure should not be obstructed.

f. Operation and Maintenance Manuals. Provide documentation on all building systems for the guidance of the maintenance staff. This should show the actual elements that have been installed, how they performed during testing, and how they operate as system in the completed facility. Included in the manuals shall be a defined maintenance schedule with maintenance task delineated in the schedule.

Provide the maintenance staff with the following:

Record drawings and Specifications.

Operating manuals with a schematic diagram, sequence of operation and system operating criteria for each system installed.

Maintenance manuals with complete information for all major components in the facility.

g. Operating Instruction. Provide operating instructions for maintenance staff at the time of commissioning the mechanical systems. The amount of instruction time provided should be commensurate with the complexity of each system.

6. Control Systems

a. Automatic Temperature and Humidity Controls

All controls must be compatible with Johnson Controls Metasys.

Controls. Use pre-programmed single or multiple loop controllers to control all HVAC and plumbing sub-systems.

Temperature Controls. Control heating and cooling energy in each zone by a thermostat located in that zone. Independent perimeter systems must have at least one thermostat for each facade of the building with a different orientation.

Night set-back controls for the heating season for summer conditions must be provided for all comfort conditioned spaces, even if initial building occupancy plans are for 24-hour operation. Morning warm-up must be part of the control systems.

b. Air Systems. Systems supplying heated or cooled air to multiple zones must include controls that automatically reset supply air temperature by representative building loads or by outside air temperature. Temperature should be reset by at least 25 percent of the design supply-air to room-air temperature differential. Zones that are expected to experience relatively constant loads, such as interior zones, may be designed for the fully reset supply temperature.

Hydronic Systems. Systems supplying heated and/or chilled water to comfort conditioning systems must also include controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outside air temperature.

c. Testing and Balancing Equipment and Systems

Testing Stations. Provide permanent or temporary testing stations to permit testing of building systems. Design connections so temporary testing equipment can be installed and removed without shutting down the system.

Water flow measuring devices are required for each refrigeration machine and for chilled water lines serving computer rooms.

Thermometers and Gauges. Provide instrumentation at each measuring point to verify capacities, temperatures, flow rates and any other critical parameters.

Provide duct static pressure gauges for the air supply fan or in individual duct runs, if multiple pressure measurement is used.

Place pressure gauges on both sides of filters in the air handling unit.

Provided a static pressure gauge to measure building pressure.

A temperature gauge is required at the outside air intake.

7. Building Automation System (BAS)

a. A BAS is not required for every project but is mandatory on large, new buildings and major modernizations. The City uses Johnson Control's Metasys as its standard equipment controllers.

b. Energy Measurement Instrumentation. The capability to allow maintenance staff to measure energy consumption and monitor performance of system specific loads (i.e. HVAC separate from lighting). is critical to the overall success of the system. Electrical values, such as V, A, KW, KVAR, KVA, PF, KVAH, Frequency and Percent TDH, should be measured. Installation of a G.E. Power Management Control System is highly desirable.

c. Control fans in restrooms automatically so they do not operate during unoccupied periods.

M. Plumbing Systems

a. Provide water pressure reducing valves to limit water distribution pressure to 80 psig. Minimum pressure during heavy usage not to be less than 60 psig.

b. Provide sufficient domestic hot water storage tanks to accommodate peak load demands of building. Locate tanks close to point of application to minimize hot water and recirculation water requirements. Hot water recirculation to be provided for distribution systems over 50 feet from heater. Provide floor drain within 5 feet of hot water heater to accommodate pop-off and any water leaks.

c. Provide plumbing systems with sufficient shut-off/isolation, and drain valves to permit localized repairs without need to shut down complete systems. Place unions at all equipment, etc. that may require removal or replacement.

d. Domestic hot water systems should be capable of maintaining 90-105 degrees F. Where higher temperature is required provide local reheaters.

e. For shower rooms provide a thermostatic temperature control or individual shower mixer cabinet and pipe tempered water to shower fittings. Use flow restrictors on showers to reduce water consumption. Consider use of push-button or automatic shower controls. Maximum flow rate: 2.00 g.p.m.

f. Locate exterior frost proof keyed hose bibbs around perimeter of building to permit watering of all landscaped areas with a standard 100 foot hose. Also provide frost proof hose bib on roof to allow for cleaning HVAC units .Each should be equipped with a pressure vacuum breaker.

g. Use commercial grade, vitreous china plumbing fixtures. Water closets shall be wall mounted to permit cleaning of floors. Where building is unattended provide vandal proof fixtures and fittings.

Toilets are to be water conserving or low-consumption (1.6 gallons/flush) types. Install automatic flush valves on all water closets, urinals and sinks. Use of waterless urinals should be considered.

h. Provide floor drain in each restroom.

I. Consider feasibility of heat recovery and solar hot water preheat where large volumes of hot water is required.

j. All pipes (including roof drains) in mechanical rooms, shafts, ceilings and other spaces accessible to maintenance personnel must be identified with color coded bands indicating type of material piped and direction of flow. Gas piping and sprinkler lines must be identified as prescribed by NFPA. Apply at every point of entry/egress through walls/ceilings.

Valves and other operable fittings must be tagged.

k. All non-metal underground piping shall have a trace wire to aid in location.

N. Insulation

1. Insulate all piping that will result in an increase in energy consumption for the building if not insulated.

2. Insulate all cold water piping and cold air duct work with sufficient insulation with vapor barrier to prevent surface condensation.

3. Insulate all hot air supply duct work.

4. Insulate all hot air and cold air duct work located outdoors or in unconditioned spaces.

5. Insulate underside of roof drains and any horizontal rainwater piping.

6. Label all insulated pipe in hot water supply system.

7. Roof and ceilings shall have R-30 or greater thermal resistance; walls shall have R-19 or greater rating.

O. General Electrical System

1. Service

a. Primary service should be based on the estimated demand load plus 35 percent spare capacity.

b. Provide the following:

1) For loads up to 175 KVA, use a 120/208V 3 phase 4 wire 600A service if possible

2) For loads greater than 175 KVA, use a 480/277 3 phase 4 wire service

c. If a vault is required, plan for a first floor location on an outside wall for natural ventilation and road access but not at the front of the building. If a transformer pad will be required check Code required clearances from the building and building openings as windows, doorways, etc. Verify with Fort Collins Utilities, Project Engineering any other clearances that may be required.

d. Motors: Specify high efficiency motors. Refer to the latest Consortium for Energy Efficiency (CEE) – CEE Premium Efficiency Motors Initiative.

2. Distribution

a. Except for the small services (175 KW and below) use 480/277V power for all motors ½ HP and larger, all fluorescent and HID lighting loads and all electric heating loads. This will minimize copper, conduit and equipment sizes.

b. Locate the service panelboard adjacent to the service transformer and as close to the load center as possible. A centrally located distribution center will reduce feeder length, voltage drop and costs substantially.

c. Power elevators from a shunt trip circuit breaker located in the elevator equipment room. See ANSI A17.1.

d. Panelboards shall use circuit breaker protection. Allow for 25% spare capacity or more if future additions are known.

Maximum 42 poles per panel board. Panelboards serving personal computers, computer terminals or dedicated work stations should have an isolated ground bus. The service to the electronic panelboard should be supplied from an isolation transformer. Size equipment with consideration given to higher harmonic currents in the neutral wire.

e. Motor controls shall be provided in centralized motor control centers (MCC's) or grouped motor control modules - located in mechanical rooms where there is the greatest concentration of motor loads.

Protection and control for motors operating heating equipment, pumps, boilers, hot water systems, sump pumps, food and refrigeration systems and other critical loads should be designed to be automatically turned "ON" in timed sequence when power is restored after a power failure. Motor controls and power wiring to motors and equipment should generally be specified by the Electrical Consultant and work done by Division 16. Control wiring should be specified and installed by Mechanical Division 15.

f. Branch wiring within the buildings shall be specified as THHN-R90 copper conductors (minimum No. 12 gauge) run in EMT above grade and in rigid PVC below grade or below slab on grade. Underground branch wiring outside the building shall be RWU-90 installed in rigid PVC at 30 inches below grade. Splices made on #10 wire or smaller shall have conductors twisted together before placing warrant connectors on splices. Splices made on #8 and larger shall utilize either mechanical- or compression-type lugs; wirenuts shall NOT be used. All wiring beneath a raised access floor should be routed in metal conduit or cable to underfloor distribution boxes. Flush mounted access floor service boxes should be attached to the underfloor distribution boxes by means of a plug-in modular wiring system to facilitate easy relocation.

g. Wiring devices shall be "Specification Grade" with matching steel plates.

h. Mark or identify panel and circuit number on all J-Boxes.

3. Lighting System

Illumination for the parking areas, roadways and walkways shall be designed according to the City plan lighting requirements and the latest version of ASHRAE / IES90.1. Building lighting shall be designed in accordance with LEEDS requirements..1. Lighting quality also needs to be given high priority in occupied spaces.

a. Illumination design shall be based strictly on the task(s) and confined to the task areas, to be carried out in the space and the level of performance set by the user, i.e. do not light a hockey rink to professional standards when only amateurs will play. Likewise, provide additional illuminance for senior citizens engaged in close or detailed work in a hobby shop. Indirect lighting in office areas shall be provided if feasible.

1) Design circulation areas to one third the task illuminance level in that room.

2) Walls, ceilings and other room surfaces should be lit with either direct or indirect light so that the overall room luminance ratios are approximately 5:1. An example of poor luminance ratios would be from a low glare troffer system or from an area lit with only down lights. The floor and working surfaces are bright, yet the walls and ceilings are dark. Another example would be the luminance ratio between a window and the wall where it is located. The wall should be lighted and also painted a light color.

3) Lamps used for interior use should have at least a color rendering index equal to 80 or greater and a minimum average lamp efficacy of 80 lumens per watts. Different lamps within a same area should have similar color temperature and color rendering index.

4) Minimize reflected and direct glare. Luminaire selection and locations should be coordinated with particular tasks in an area. An example of this would be to specify low glare fluorescent in an office where computer terminals are used. The fluorescents should be located such that the luminaire image cannot be seen in the screen.

5) Vandal resistant use luminaires in all outdoor area lighting with IES recommended cut-off distribution. Shield luminaires so that there will be no light trespass or pollution.

b. In the interest of energy savings and operating economics, incorporate the following principles:

1) Use the highest efficiency lighting sources available considering color rendition and cost. Sources shall be energy efficient fluorescent (with few if any, 2 feet, 3 feet, or U-bent lamps), 4 ft. T8 rapid start lamps where possible, metal halide (MH), or high pressure sodium (HPS). If HPS lamps are proposed indoors, only lamps with acceptable color rendition should be specified, otherwise use MH. All outdoor lighting is a good candidate for HPS. Twin tube and double twin tube fluorescent compact lamps with high power factor ballasts, and double ended metal halide lamps should be used in lieu of incandescent located in down lights and wall sconces. Metal halide lamps may be considered outside when color rendering is important.

2) Use 18,000 to 20,000 hour life lamps wherever possible for lower maintenance costs. When twin tube, double twin tube florescent and low wattage metal halide lamps are used, then longer service life (compared to incandescent) will be acceptable.

3) Avoid incandescent luminaires due to their low efficiency, very short life and high power and heating content. Limit use to special areas. If incandescent lamps are used, specify 125V-130V 2,000 hours life, standard "A" type lamp for area lighting. Use low voltage MR-16, Par-36 or quartz in framing projectors for artwork and display lighting systems and limited area lighting. All incandescent systems should be dimmed in order to lengthen the lamp life.

4) Ballasts shall be electronic unless otherwise approved by the City. Ballasts for outdoor usage, ice arenas, outdoor parking, etc., shall be low temperature-30F type (with appropriate lamps).

5) Luminaires shall be chosen for high efficiency consistent with good lighting quality i.e., low brightness and low glare rating. They should be selected and located for the anticipated tasks and ambience in the area.

6) Good quality lighting should produce the required illumination with an overall maximum connected load of 1.75 watts/square foot. Maximum power densities allowed by ASHRAE 90.1 by space type using the building area method. However, depending upon the type of building, lower wattage densities can be achieved and designs should be based on the latest I.E.S. Energy Management Series of Publications (LEM's). Higher watts/square foot may be allowed if automatic light level controls are installed. This would include the design of using higher wattage lamps that are dimmed down to a desired light level in order to maximize lamp life.

7) Interior wall and ceiling finishes should have a high reflective, matte finish.

8.) Use premium efficiency motors whenever possible. See attached premium – efficiency motors initiative.

4. <u>Luminaire Types</u>

a. Specify high efficiency luminaires - fluorescent troffers at least 70%. All luminaires should have well designed optical systems with

reflectors and refractors which distribute the light where it is required. An example of a poorly designed luminaires would be a post top globe luminaires designed for outdoor use where the majority of the light goes up into the sky versus down on the pavement where it is needed.

b. Specify wire guards and/or lexan diffusers for all luminaires where units will be exposed to the public as washrooms, change rooms, athletic facilities and outdoors. HID luminaires shall have hi-stress glass gasket enclosure.

c. Select luminaires with good maintenance characteristics. Maintenance procedures to be reviewed by City Maintenance staff I.E. ease of cleaning, repair

5. Lighting Control and Energy Consumption

Limiting or managing energy consumption (i.e. connected wattage x time of usage) is the only effective key in reducing energy usage and thereby cut operating costs. Accordingly the design of the lighting controls must be thoroughly studied and proposed to provide a three to five year life cycle payback for the capital investment over a “standard” system. The following controls shall be considered:

a. Provide switching in every room preferably two level where usage changes. Consider multi-level (electronic) ballasts and dimming controls for spaces requiring different levels of lighting.

b. Consider automatic dimming devices for perimeter or skylight areas separately from interior areas. Consider automated daylight controls for perimeter or skylight areas.

c. Control outdoor lighting by photo cell "ON" and time switch and/or photocell "OFF". Only security lighting shall be left "ON" all night.

d. Consider infrared or ultrasonic sensors for small, enclosed office spaces and toilet areas. Each occupancy sensor should control no more than 12 fixtures. Each occupancy sensor should be market by a label identifying the panel and circuit number. Occupancy sensors should not be used in open office areas, spaces housing heat producing equipment or corridors.

e. Consider photoelectric sensors for fixtures adjacent to glazed areas and for parking structures.

f. Consider lighting control panels for complete building lighting system control with network compatibility to centralized computer system.

6. Emergency/Exit Lighting

Provide certified emergency battery sources for remote high efficiency quartz heads to meet the Codes for emergency lighting. For larger buildings, i.e., office complexes, consideration should be given to a diesel generator or a UPS to supply emergency power for lighting and essential loads and as covered by Code.

7. Fire Alarm System

Provide a fire/visual alarm system as required in a facility in strict accordance with the current Codes and ANSI A 117, 1-92.

8. Communication Services

After requirements are known, coordinate design for this service with the City's CTS Division. See Appendix G.

9. Wiring and Grounding Techniques

Wiring recommendations for proper operation of computers/programmable controllers/microprocessor-based electronic equipment of all types are:

A. Distribution systems must be designed around the harmonics problems. (Double neutral size, de-rating transformers, etc)

B. True R.M.S. metering for voltage and current must be utilized.

C. Earthing conductors should be CAD welded (chemical bond) to the earth/grounding rod.

D. Earthing conductor (from Main Distribuion Panel to earth/ground rod) should be at least 500 mcm, or larger as determined by actual need.

E. Grounding conductors (from load and sub-distribution panels) should be sized parity (same size) with the phase conductors feeding that panel. Sensitive load panels should have grounding conductor run uninterrupted to the MDP main building ground bus.

F. Avoid ground loops by avoiding multiple grounding points.

G. Use a SINGLE REFERENCE POINT for all GROUNDING.

H. Ground reference should ONLY BE TO THE BUILDING SERVICE ENTRANCE GROUND BUS (usually at the MDP panel.)

I. Use only insulated grounding conductors (to avoid multiple ground references inadvertently to steel, conduit, etc.) This will also avoid RFI introduced through the “antenna” of the building steel and conduit.

J. Up size conductors by one size for each 75 feet of run from distribution point. Computer circuits will operate better when #10 awg is minimum size for a 15-20 amp circuit.

K. No more than 2 or 3 (preferably 2) computers should be fed by a single circuit.

L. Neutral conductors feeding a three phase distribution (or a three phase electronic power supply load with a single neutral) should be TWICE THE SIZE OF THE PHASE CONDUCTORS.

M. DERATE TRANSFORMERS due to high peak current crest factors (HARMONICS) with computer and electronic power supplies of all types (UPS or other rectifiers, VFD motor controllers, etc.) Specify high efficiency transformers. Refer to the latest Consortium for Energy Efficiency (CEE) High-Efficiency Commercial and Industrial Transformers Initiative.

N. Plan wiring/circuit breaker loading at 50%.

O. For electric loads DO NOT “DAISY CHAIN” OR RUN “HOME RUNS” WITH SINGLE NEUTRAL TO THREE PHASE LOADS.

P. Transeint Voltage Surge Suppression (TVSS) equipment SHOULD BE INSTALLED WITHIN 6" OF LOAD PANEL WHENEVER POSSIBLE for maximum effectiveness. Install as close as possible to the load bus bars or load wiring when 6" is not possible.

IV. Specifications

A. Purpose of Specifications:

Specifications are used as a basis for tendering, as a contract document and for direction in construction. They should not be used to define the amount of work required since this can usually be better shown on the drawings. Reference to the drawings is necessary in order to make them part of the legal Contract Documents. Specifications should not attempt to define the extent of the work to be performed by a subcontractor since it is the contractor's prerogative to assign work.

B. Fundamentals of Specification Writing:

1. Use clear, precise definitions stated in sufficient detail to permit only one interpretation.

2. Consider each word, phrase, sentence and punctuation mark since the specification may come under the scrutiny of a court.

3. Avoid repetition but do not confuse requirements by using similar wording just to avoid repetition. Choose the word which exactly conveys the desired meaning and use it as many times as necessary.

4. Write in the directive style in the imperative mood. This eliminates many words and increases the ease of interpretation. This style can be achieved by simply deleting such phrases as "shall be" and stating the requirement in the imperative mood.

5. Use the CSI (Construction Specification) Format.

6. Write the specification stating only requirements which can be enforced. Do not include requirements which cannot or will not be enforced. Requirements which depend on qualifications based on assessment by the individual rather than qualification against stated facts or standards are useless and only confuse those who use the specifications.

7. Use only designations contained in the Articles of Agreement or general Conditions. For example, use Consultant, contractor, subcontractor, Owner, NOT vendor, purchaser, supplier, tenderer, bidder, etc.

8. General and Supplementary Conditions are pre-printed forms supplied by the City intended to precede the Specification in the Contract Document package. Check the specifications against the General Conditions to insure that no conflict in instructions or information exists. The City uses the 1990 edition of the EJCDC General Conditions of the Construction Contract.

9. Courts have generally held that in the event of conflict between drawings and the specifications, the specifications, as a written document, govern. Therefore, they must be written clearly and not be conflicting.

10. Staff training on installed equipment must be included. The training requirements shall be coordinated with the facility user and the maintenance branches.

C. Division Format

1. The Division Format shall be the "Master Format" which has been recommended for use by the Construction Specifications Institute.

2. The Specifications Format comprises the following Divisions:

Division	0	Bidding and Contract Requirements (provided by City)
Division	1	General Requirements
Division	2	Site Work
Division	3	Concrete
Division	4	Masonry
Division	5	Metals (Architectural & Structural)
Division	6	Woodwork
Division	7	Thermal & Moisture Protection
Division	8	Doors, & Windows
Division	9	Finishes
Division	10	Specialities
Division	11	Equipment
Division	12	Furnishings
Division	13	Special Construction
Division	14	Conveying Systems
Division	15	Mechanical
Division	16	Electrical

3. In the Specifications Format, two words become very important. These words are "Division" and "Section". The word "Section" as used in the Format denotes the "technical section". The word "Division" is used to denote a group of "sections".

4. The "Divisions" are the permanent unchanging framework of the Specifications Format. They are fixed in number and name; as titles they appear only in the Index.

5. The number system of the Format is very simple. As stated above, the "Division" number and title is fixed. The "Section" is identified by a complete numerical identification system (e.g. Section 03300, Section 07500, Section 09400, etc.)

D. Constructibility Review General Guidance

Building construction estimated to have a cost of more than $3,000,000 shall have a constructibility review. This will be done by the Architect and by the Project Manager in accordance with the review guidance (Appendix A).

NOTE: The following specification format should include items noted but by no means is all-inclusive.

E. General Requirements

1. Division 0
Refer to Division 0 of the City's Standard General Specifications for the Contract.

2. Division 1
Refer to Division 1 of the City's Standard General Specifications for the contract. This section will need to be coordinated with the A/E's Division 1.

F. Division 2 - Site Work

1. Earthwork

a. General

1) Specify protective barriers required for adjacent property, trees, bench marks, trenches, pits, vulnerable exposed surfaces, etc.

2) Specify removal of water from all excavations.

3) Specify compliance with the Occupational Health and Safety Act.

4) Control soil erosion and tracking dirt onto streets. (See City criteria).

b. Products

1) Materials

Specify site fill materials, vapor barriers, bedding materials and weeping tile.

c. Execution

1) Direct Contractor to visit and closely examine the site so as to be aware of existing conditions.

2) Advise Contractor if a soils report is available and what responsibility the Owner/Architect take for its accuracy.

3) Site Preparation

Specify requirements for topsoil removal, erosion control measures and storage (if required). Indicate if any other extraneous materials are to be disposed of.

4) Excavation

Indicate what excavation is to be done by this trade (i.e. is mechanical and site service work included). State who will approve bearing surface. Insure these exposed surfaces are properly protected. State how excavated material is to be disposed of. Provide warning regarding existing buried services. Specify protection for all exposed critical surfaces from freezing. Specify requirements for dewatering and working below the water table (sumps, well points, etc.).

5) Backfilling

Specify when backfilling may begin. Specify materials to be used in specific situations, compaction required and thickness of layers acceptable. Warn against backfilling one side only of walls likely to be adversely affected. All service line trenches shall be mechanically compacted; no water-jetting allowed.

6) Specify special requirements for backfilling under slabs on grade, paving and buried services.

7) Specify precompaction of virgin ground to be built on, that may have been affected by frost or is soft for other reasons.

8) Specify bedding requirements for buried services if included in this section.

9) State what testing is to be done, testing sequence, and who will appoint and pay testing company.

10) Specify quality of rough grading in terms of tolerance and its relation to the proposed surface treatment.

2. <u>Landscaping</u>

a. Plant Materials

1) All plant materials are to comply with the published horticultural standards of the American Association of Nurserymen to grading and quality.

2) All plants are to be No. 1 Grade, Colorado nursery-grown, under proper cultural practices with respect to fertile soil, ample spacing, regular cultivation, weed, pest and disease control, adequate moisture and pruning, in accordance with good horticultural practices. All such plants shall have been transplanted and/or root-pruned regularly, but not later than one growing season prior to arrival on the site.

3) The sizes of root balls for trees shall be sufficiently large to contain at least 75% of the fibrous root system.

4) For deciduous trees with a caliper of more than 6 inches and for coniferous trees over 18 feet in height, create a unique specification for the approval of the City Forester. Unusually large size specimens require very special handling.

5) Non-dormant, cold storage, frozen balled or large bare-root stock may only be used if approved, in advance, by the City Forester. Tree spade dug material and container stock is generally acceptable although tree ball sizes must be monitored.

6) Substitutions of specified material must be approved by the City Forester.

b. Topsoil

Friable natural loam with an acidity range 5.5 pH to 7.5 pH, containing organic matter a minimum of 4% for clay loams and 2% for sandy loams, and free of stones and roots over 2 inches in diameter, and subsoil, clay lumps, and other solid materials. (Verify the use of existing topsoil-check soil report). Stockpile topsoil on site for landscaping purposes. All topsoil intended for use or reuse is to be tested both to conform to this specification and to ascertain N.P.K. ratio for fertilizer requirements. Remove excess topsoil from the site and dispose of as City directs. All soil stockpile areas are to be restored as part of general site development.

c. Seeding

Note: Seeding will only be permitted for large areas, such as play fields, and only where approved by Parks and Recreation Department.

1) Grass Seed

Prepared and mixed by an approved seed house, tested to be within rates for purity and germination specified by government standard. Mixture to be appropriate to site conditions to the satisfaction of the Parks and Recreation Department.

2) Hydro Seeding

Hydro seeding and mulching will be permitted in lieu of the usual methods if circumstances warrant, subject to approval by the Parks and Recreation Department.

d. Sodding

1) Certified No. 1 cultivated turf grass sod, grown and classified in conformance to established standards. It shall have at least two years growth from time of seeding, strong fibrous roots, and no stones, or burned or bare spots.

2) Mixture of grass varieties in sod shall be as specified by the Parks and Recreation Department.

e. The specific design of underground sprinkler systems will be done by a designer having proven experience in irrigation design. The design must be approved by the Parks Department.

f. All plant material must be warranted for one year. The sprinkler system will be warranted for one year including blow-out and turn-on by the contractor. The turf must be warranted for one year. All of these warranties are effective beginning from the completion and acceptance of the specific installation and not necessarily at substantial completion of the facility. A time must be agreed to among the contractor, the A/E, and City staff.

G. Division 3 - Concrete

1. Concrete

a. General

1) State tolerances required. Reference: Practice for Concrete Form work (ACI 347-78).

2) State responsibility for design of form work.

3) All concrete shall be minimum 3,000 PSI design strength or as determined by structural consultant.

4) For pre-cast concrete the manufacturing plant shall be certified by the pre-cast/pre-stressed concrete institute.

5) Use re-usable forms to reduce waste.

b. Materials

1) State materials required in form work panels and columns (rectangular, round).

2) State type of form ties required. Note special requirements.

c. Execution

1) Define quality of form work construction required (finish, joints, layout).

2) State responsibilities for supplying and building in of inserts (reglets, anchors, water stops, etc.)

3) State minimum stripping and reshoring requirements.

4) Provide description of various types of formed surfaces required for the project.

2. Concrete Reinforcement

a. General

1) Statement of proposed inspection and testing

2) State shop drawing requirements not covered in General Conditions, such as scale, standard (e.g. ACi 315-74) and any special items to be covered.

3) Reinforcing shall be grade 60 or as recommended by the structural consultant. Should be coated to prevent corrosion.

b. Materials

1) State quality of reinforcement to be used including both rods and welded wire fabric.

2) Define requirements for bending (i.e. standards, shops versus field bending).

c. Execution

1) State standards for placing including cover, spacing and chairing.

3. Cast-in-place concrete

a. General

1) Require records of all concrete delivered to site including date, delivery slip number, location in project, tests made and weather conditions.

2) Require submittal of concrete mix for approval before work commences.

3) State testing proposed and who will appoint and pay the testing company.

4) State environmental restrictions to be adhered to (i.e., define "cold" and "hot" weather) and protection required.

b. Material

1) State requirements for water, cement aggregate for the project including any special requirements such as white cement, sulfate resisting cement, colored aggregate, etc.

2) Define admixtures required such as water reducing, air entraining, etc.

3) Define water stops to be used.

4) Define other products required for this work such as non-shrink grout, curing agents, polyethylene, etc.

5) Concrete Mix - Define requirements for mix design such as by whom, specified strength versus durability to environment, special density, placing requirements, etc.

c. Execution

1) State requirements for placing, including vibrating, suitability of ground/forms to receive concrete, protection from weather, precautions to insure uniform pour to obviate cold joints, honeycombing, etc., and pumping.

2) State requirements for construction, control and expansion joints.

3) Define where water stops are required if not covered on drawings.

4) State any requirements to apply to other trades such as mechanical, electrical and structural steel.

5) Define requirements for finishing concrete such as for paint, sandblasting, bushhammering, etc.

6) State requirements for saw cutting such as timing, spacing, depth and finishing.

4. Concrete Finishing

a.

Finish Type	Location
Screened and Bull Floated	Skim coats, pits
Screened, Bull Floated and Scored with Wire Brush	Base slab for tile or bonded topping
Powered Steel Trowel Finish	Floors which receive resilient flooring, carpet, or future floor
Powered Steel Trowel Finish With Non-Slip Swirls	Interior exposed slabs

Wood Float Finish with Brooming	Exterior exposed slabs
Hardened Concrete with Powered Steel Trowel	Exposed slabs in shipping, receiving and hockey rink slabs

b. Floor Surface Hardeners

Non-metallic natural grey color

5. Curing

Specify method of curing that is compatible with floor finishes to be applied. Do not use curing compound on floors or stairs to be painted.

6. Floor Sealer

Use non-toxic and V.O.C. free sealers.

H. Division 4 - Masonry

1. Mortar

a. Use materials specified in ASTM C270

b. Add a bonding agent to mortar

2. Masonry

Use normal weight concrete block for foundation walls and walls exposed to weather. Do not use lightweight block in these locations. Use bull nosed units for exposed corners.

3. Shrinkage Control Joints

a. Incorporate vertical shrinkage control joints in walls of which concrete Masonry units are a part.

b. Provide control joints on line of door opening jambs from head to top of wall. Cut false joints in concrete and block lintels exposed to view, to line up with control joints.

c. Provide complete vertical separation through walls incorporating control joints.

4. Joint Reinforcement

Reinforce solid and cavity concrete Masonry unit walls and partitions, single with brick walls, and walls and partitions where thickness is reduced by columns, piers, chases, or such.

5. Weather Protection

Provide weather protection for all free standing structures, walls and floors until complete. Exterior Masonry walls are to be impervious to moisture penetration from driving rain.

6. Cavity Walls

Provide free draining weep holes at bottom of cavity walls and over through wall flashings. Install flashings in accordance with the Uniform Building Code.

7. Choose materials which will minimize efflorescence.

I. Division 5 - Metals

1. Structural Steel

a. General

1) State required qualifications for this trade such as experience welding certification, etc.

2) State testing and inspection required and how it is to be paid for and who will appoint the company

3) State special shop drawing requirements such as scale and what special items are to be covered

b. Products

1) Materials

State requirements for standard hot rolled sections, hollow structural sections, cold rolled sections, plates and fasteners

2) Fabrication

a) State workmanship standards

b) State welding standards

c) State any special items to be noted (e.g., Masonry anchors holes in members, requirements of other trades, base plate setting method, etc.)

d) State bolt and anchor requirements

3) Paint

State preparation required and paint to be used

c. Execution

1) State standard to be adhered to

2) State responsibility for temporary bracing design and how long it is to remain in place

2. Open Web Steel Joists

a. General

1) State required qualifications for this trade such as experience, welding certification, etc.

2) State testing and inspection required and how it is to be paid for and who will appoint the company

3) State special shop drawing requirements such as scale, camber, materials proposed and calculations required

b. Products

1) Materials

a) Steel, paint, bolts, etc.

b) Design requirements including deflection, special bridging provision for ducts and chord extensions

c. Execution

1) Requirements for fastening

2) Requirements for bridging

3. Metal Decking

a. General

1) State required qualifications for this trade such as experience, welding certification, etc.

2) State testing and inspection required and how it is to be paid for and who will appoint the company

3) State special shop drawing requirements such as scale, material notes, sheet layout deck profiles, etc.

b. Products

1) Materials

a) Specify grade of steel, coating and profiles, (regular, composite or acoustic).

b) Specify design standard as well as any restrictions on the design such as gauge, deflection, length of sheets. Note special requirements for composite deck to receive concrete.

c) deleted

2) Installation

Specify details of fastening, restrictions on hole cutting and paint touch-up of welds.

4. Steel Stairs and Railings

a. Materials

1) Steel

Flat and rolled shapes conforming to Grade 44W; hollow structural sections to Grade 50W; pipe conforming to ASTM A-53 Grade "B". All material shall be new, free from defects impairing strength, durability or appearance and of best commercial quality for the purposes intended.

2) Specify materials, component sizes, gauges of metals, anchorage and fastenings that shall withstand the intended use within allowable design factors, as required by the Building Code. Specify that all work is free of warping, buckling, opening of joints and seams, distortion and permanent deformation.

3) The fabricator shall design the details of the railings and stairs, and the connections to the building structure, to satisfy the requirements of the Uniform Building Code, and shall provide copies of the calculations stamped by a registered Professional Engineer if so requested. Fabricate all components in compliance with these design details.

J. Division 6 - Woodwork

1. Rough Carpentry

a. General

1) State requirements/grades of lumber products to be used.

2) Use formaldehyde - free resins in particle board and plywoods in occupied spaces

b. Prefabricated Timber Trusses

1) Trusses shall be designed by an Engineer engaged by the supplier and fabricated to safely carry the loads shown on the drawings.

2) Shop drawings shall be signed and stamped by the Supplier's Design Engineer. They shall clearly indicate material grades, connectors, temporary and permanent bridging and connections to the framing.

3) Submit for review, brochures indicating wood connectors and fasteners proposed to connect structural members. If requested, submit samples of connectors together with structural calculations and/or test results with respect to load capacity of each type of connector.

4) Where exposed, fabricate trusses with particular regard to appearance. Connectors must be placed square and without unnecessary overhangs, and shall be visually in keeping with the character of the building. Splices are to be made accurately and chord members straight and parallel. Wood members shall be chosen for appearance with a minimum of small knots. Kiln dry all material.

c. Exterior Woodwork

1) Avoid the use of exterior woodwork and timber, substituting materials of greater longevity wherever possible such as, for example, pre-cast concrete units for retaining walls, painted steel for trellises, metal cladding for building walls, etc.

2) When used, all exposed wood is to be quality cedar and/or quality material pressure treated with an environmentally friendly preservative. Structural and aesthetic qualities which determine wood type are still applicable despite preservative treatment. Material must be sufficiently "cured" before using where direct contact with plant materials is likely.

3) Use paint or stain, if necessary, of a type compatible to preservative material as recommended by manufacturer to prevent non-adhesion and/or blistering.

K. Division 7 - Thermal and Moisture Protection

1. Dampproofing

a. Confirm with soil investigation report the need to use damp proofing

b. Specify emulsified mineral colloid type, unfilled

c. Apply to exterior side of foundations against earth when rooms occur below grade

2. Waterproofing

a. Confirm with soil investigation report the need to use waterproofing.

b. Use either rubberized asphalt waterproofing or asphalt emulsion type including primer together with coated glass cloth membrane.

c. Apply on exterior side of vertical faces of all walls which separate interior of building from earth, from grade, down over footings to bearing level. Use two ply system for walls to 10 feet below grade; three plies to 20 feet and four plies to 30 feet.

d. Use insulation as a protection board where feasible.

3. Preformed Metal Cladding

a. Design Requirements

1) Design cladding to support a positive wind load of 20 psf and a negative wind load of 12 psf at a deflection not to exceed 1/180 of the span.

2) Design wind loads specified in above clause shall apply to surface or part of surface located up to 40 feet above grade. For surface or part of surface located more than 40 feet above grade, these design loads shall be multiplied by appropriate exposure factor, as listed in the Uniform Building Code.

b. Use rolled steel

c. Paint Finish (baked-on enamel or porcelain enamel can be considered)

1) Precoated paint finish shall be selected from standard color range.

2) The paint film shall meet the standards for precoated galvanized sheet steel based on exterior use.

4. Caulking

a. Materials

Specify materials designed for use on surfaces encountered, and as specified by the compound manufacturer, to assure adhesion of compound and to prevent staining of substrate material

b. Application

Perform work in accordance with compound manufacturer's specifications, under his supervision, and using pressure guns and other equipment as provided by him. Finish joints so that they are smooth, and free from ridges, wrinkles, air pockets, and embedded foreign materials.

5. Roofs - Class A and Complying With Class 90 Wind Uplift Resistance

Verify minimum. slope requirements with laser transit before final roofing coverage.

a. Built-Up Bituminous Roofing

1) Conform to manufacturer's details. Material and workmanship warranty for the total system should be for full value for fifteen (15) years.

2) Minimum construction shall consist of:

a) Deck sloped minimum 1/4" per foot (1:50) to roof drains.

b) Roof drains located at 40 foot on centers maximum

c) Vapor barrier

d) Minimum insulation value of R20

e) Perimeter mechanical fastening of insulation

b. Modified Bitumen Roofing

1. Material and workmanship warranty for the total system should be for full value for 15 years.

2. Minimum construction shall consist of:

a) Deck sloped minimum 1/4" per foot to roof drains

b) Roof drains located at 40 foot on centers - maximum

c) Vapor barrier

d) Minimum insulation value of R20

e) A finish coat such as "acrylic coating" or aluminized asphalt coating

c. Single-ply Roofing

1. Material and workmanship warranty for the total system should be for full value for 15 years.

2. Minimum construction shall consist of

a) Deck sloped minimum 1/4" per foot to roof drains

b) Roof drains located at maximum 40 foot on centers

c) A EPDM Roofing System that is fully adhered and non-ballasted. A minimum of a 15 year warranty from time of installation.

d) Non-penetrating mechanical attachments

e) Minimum insulation value of R20

d. Asphalt shingles:

1.) Should be installed over an iced and water shield where necessary.

2.) A minimum of a 15 year warranty from time of installation.

6. Insulation

a. Thermal barriers should be provided by locating service areas such as washrooms, stairs, corridors, etc. along the perimeter, especially the northern one, where possible.

b. The most efficient orientation of the building and its parts, such as windows and doors should be selected.

c. Use berming and other forms of windbreaks when feasible.

d. The building envelope's thermal insulation shall be as continuous as possible and comply with the City's non-residential Energy Code.

e. For site work specify insulation, particularly to protect services where necessary or warranted.

f. Foam insulation should be made without CFC's or formaldehyde components. Molded Expanded Polystyrene (EPS) or cellulose insulation should be considered. Products should have at least a 15 year R-value warranty.

7. Vapor and Air Barriers

a. Where a building assembly is to be subjected to a temperature differential and a differential in water vapor pressure and will be adversely affected by condensation, the assembly shall be designed to prevent condensation by providing a continuous vapor and air barrier in the assembly on the high vapor pressure side of the material that has the major thermal resistance.

b. Where a material or combination of materials that have a resistance to water vapor flow equivalent to that of a vapor barrier are used on the low vapor pressure side of the material that has the major thermal resistance in a building assembly:

1) A continuous vapor barrier, for use in above-grade building construction, shall be installed on the high vapor pressure side.

2) An air space ventilated to the outside or other method of equal effectiveness shall be provided for removing the water vapor that may pass from the high vapor pressure side through the material with the major thermal resistance.

8. Walk Treads

All roofs shall have walking treads to equipment on the roof. These shall be compatible with the roof system.

L. Division 8 - Doors and Windows

1. Windows

a. Glazing shall be energy efficient (ie; Low-E) and have a insulated glass certification council markup of “CBA”.

b. Use thermally broken sections if metal window frames are used. Do not use steel windows.

c. Consider pivot type, wrench operated windows to allow emergency ventilation, window crank location shall not interfere with window coverings.

2. Doors

a. Provide vestibules for all entrances.

b. The glazed portions shall be of sealed insulated double glass units. Consider Low-E glass.

c. Exterior doors need not be protected with a vestibule where:

1) The door is used primarily to facilitate vehicular movement or material handling

2) The door is not intended to be used as a general entrance door

3) The door opens directly from an enclosed space of less than 1,650 square feet in area

3. Hollow Metal Doors and Frames

a. Construct fire-rated doors and frames of ratings indicated, in accordance with lAO 80 "fire doors and windows", as adopted by Insurers Advisory Organization, and as otherwise required by Jurisdictional Authorities.

b. Insulate exterior doors and frames

c. Fabricate frames of not less than 16 gauge wire coated cold rolled furniture steel and doors of not less than 18 gauge

d. Prepare frames and doors for specified finishing and security hardware with mortises and reinforcement. Provide 10 gauge steel plate reinforcement for hinges, electric strikes and electric contactors, and 12 gauge for pushes, pulls, lock and latch sets, and panic devices. Drill and tap to template information. Reinforce for surface-mounted hardware and for door closer brackets. Provide for concealed door closers where specified. Install 22 gauge metal mortar guards at cutouts and reinforcing plates in frame. For cylindrical locks, install reinforcing units to lock manufacturer's specification. For mortise locks provide a suitable internal bracket to hold the lock rigidly in the center of the door.

4. Wood Core Doors

a. Cores may be 28 lb. high density particle board (Formaldehyde free).

b. Fabricate doors of solid core construction minimum 1-3/4" thick

c. For plastic facing use 0.045" to 0.050" thick General Purpose Regular

5. Store Front Systems

a. Store front systems shall be equal to Kawneer Trifab 450 system Systems shall have minimum 4" styles and rails.

6. Glass and Glazing

a. Conform to all applicable requirements of "Glazing Manual" published by The Flat Glass Marketing Association, Topeka, Kansas.

b. Glass shall conform to the following:

1) Safety Plate Class - to ANSI, minimum 1/4" - use either fully tempered or laminated, minimum thickness of vinyl 0.015"

c. Use double or triple glazing when necessary to provide consistent "R" ratings for energy efficiency and to prevent undesirable condensation.

d. Low-E glazing shall be used.

e. Use FireLite fire-rated glass as appropriate.

7. Door Hardware

a. Hinges

1) Types

Provide the proper types to suit door and door frame requirements. For doors with closers, provide ball-bearing butts. For all other doors, provide plain bearing butts.

b. Locks and Latches

1) Types

All lock/latch sets, including cylinders, shall be Schlage primus series. Latch sets to have lever handles.

2) Keying

a) Provide 5 temporary construction keys to the project manager. All cylinders shall be grand master keyed to the City of Fort Collins keying system.

b) City will provide knox box. Mount as directed by the Poudre Fire Authority.

c) Contractor will provide key cabinet for building keys as needed.

c. Closers

1) Shall meet ADA criteria.

2) Public exterior entries identified as handicap accessible routes shall have automatic door openers.

d. Door Stops

1) Types

Provide the proper type of stop to all doors to prevent damage to hardware, doors, and walls. In general:

a) Where doors open against a wall, provide a wall-mounted stop.

b) Where doors are unprotected, vulnerable to high-frequency use or wind conditions, on all exterior doors, provide overhead stops. Do not use door closer arms as door stops, unless it is specifically manufactured as a door stop arm type.

c) Where other stops will not suit the condition, floor-mounted stops may be accepted.

2) Finishes

To match door hardware

3) Weather stripping

Provide replaceable weather stripping at exterior and vestibule door openings.

4) Smoke seals, etc. as required by UBC.

8. Electronic Access Controls

Card reader system and door hardware shall be Motorola Indala proximity access readers with Continental Controls access controller field terminal units. See Appendix F for complete access control standards..

M. Division 9 - Finishes

1. Drywall Construction

a. Steel Studs

Fabricate from appropriate gauge hot-dip galvanized sheet steel with holes or knock-out panels for services to ULC requirements. Provide with all matching runners and accessories complete. Provide extra bracing in recreational areas.

b. Gypsum Wallboard

Where gypsum wallboard ceiling and wall finishes are used, provide minimum thickness of 5/8" - type "X". Use water-resistant/proof board for wet areas.

c. Application

Secure wallboard by screws directly to metal furring.

d. Joint Treatment

Fill joints by means of three-coat tape and plaster method

e. Hangers for Drop Drywall Ceilings

Anchors to be drilled, not shot

f. Building must be made water proof, including window installation, before drywall is brought into the building.

g. Sound Attenuation Batts

Provide mechanical fasteners to secure batts in position

h. Main corridors shall have surface mounted corner protection for wallboard.

2. Ceramic Wall Tile

Tile shall conform to established standards. Grout to be pigmented dark color and sealed. Epoxy grout is to be used in restrooms and shower areas. Tile wall in restroom to extend to minimum of three-fourths (3/4) wall height. Consider specifying recycled materials (ie; Stoneware Traffic Tile). Use thin set master application.

3. Resilient Floor Tile

a. All resilient tile shall be at least 0.080" thickness, except in public traffic areas, where 1/8" shall be used. Use of "solid" vinyl tile over VCT should be considered in a life cycle cost analysis. Adhesive to be water based..

b. Center all joints between floor finishes directly under the door.

c. Provide an extra supply of each type and color of tile for future replacement purposes.

d. Install all tile with pattern running one way only, parallel with longest wall, staggered one-half tile.

e. All white or all black vinyl composition tile should be avoided. Medium tone colors preferable.

4. Bases

a Resilient bases shall be coved bottom, grooved back, preformed external corners, 4" high, minimum 1/8" thick, rubber. Burke brand is preferred.

5. Interior Concrete Floors and Steps

a Machine trowel all interior floors and steps. Seal floors and steps not scheduled to receive a further finish such as resilient flooring with a transparent polyurethane coating.

b. Provide each set tread with two inset carborundum strips, running full width of tread and landings. Stairway nose guards shall be solid and “dark” in color.

6. Quarry Tile

a. Provide all main entrances, vestibules, and lobbies with quarry tile flooring, with integral bases.

b. Adhere quarry tile with thin-set Portland Cement adhesive with appropriate additives for durability, etc. Grout joints with water proof cement grout.

c. Slope floors 1/8" per foot from the walls to floor drains.

d. Quarry tile to have non-slip finish.

7. Carpeting

a. Carpet shall have a minimum 10 year performance/wear guarantee and be of commercial grade.

b. Carpet tiles (thirty-six inch) are first choice unless other considerations dictate broadloom use. Must be compatible with access floor system if used. Carpet tile to be recyclable.

c. Carpeting shall have the following minimum construction and performance characteristics:

Type Face Yarn	100% Fourth generation nylon
Yarn Dye	Solution dyed preferred
Coloration	Multi-colored tones camouflage soil, avoid light colors
Pile Height	Between 0.187 (3/16) and .5 (½) inches
Stitches	8 Stitches per inch
Tufts	80 Tufts per square inch
Tuft Bind	Greater than or equal to 20 lbs.
Gauge	1/10 (270 pitch)
Static Resistance	Below 3.2 kilovolts as tested under AATCC-134 (for computer rooms-less than 1 KV with charge delay of less than 2 seconds)
Pile Weight	28 oz./sq.yd.
Primary Backing	Min. 3.5oz./sq.yd. spunbonded polypropylene
Laminate Backing	30 oz./sq.yd.
Secondary Backing	Min. 7 oz./sq.yd.
Total Weight	62 oz./sq.yd.

d. All carpet shall exhibit outstanding stain, abrasion resistance. Shall be loop pile construction.

e. Carpet tile yarn should be fusion bonded. State the extra supply of each color/type desired for future replacement.

f. Carpet must display the Carpet and Rug Institutes' (CRI) Indoor Air Quality Testing label showing that the carpet has been tested and meets the criteria for low emissions. Adhesive must show that it met CRI Indoor Air Quality Adhesive test.

8. Painting

a. Products

All paint products to be high quality and have Low VOCs. Aqua Fleck multi-color system should be considered where applicable. A minimum of a low sheen, such as eggshell or statin, for all interior wall finishes.

b. Interior Schedules

Paint all interiors throughout with sufficient coats to provide adequate coverage and uniform sheen, but in no case less than the number of coats specified. (Minimum DFT (dry film thickness) for prime and finish coat is 5 mils.)

c. Contractor to proceed with work only when surfaces and conditions are satisfactory for production of a first-class job. Surfaces must be inspected and approved by project manager or his representative just prior to each coat application.

d. Preparation

1) Concrete

a) Test surfaces for alkalinity with pink litmus paper or other recognized method.

b) Where extreme alkalinity occurs, wash surface with 4% solution tetra potassium pyrophosphate (5 oz./gallon of water) where latex-base paint is to be used and with zinc sulfate solution (3 lb./gallon of water) where other paint bases are to be used.

c) Etch normal concrete surface to receive alkyd paint with muriatic acid solution (1 part commercial 31.45% with 3 parts water).

2) Metal

Clean unpainted and shop-painted metal, removing loose rust. Prime bare metal with zinc chromate primer, feather out edges to make touch up patches inconspicuous.

3) Galvanized Surfaces

Phosphatize galvanized metal surfaces using pre-treatment or prime with galvanized metal primer.

4) Woodwork

a) Inspect mill work to assure surfaces are smooth, free from machine marks and that nail heads have been countersunk. Seal all knots and sapwood in surfaces to receive paint with a sealer compatible with finish specified.

b) Sand smooth all woodwork which is to be finished and clean surfaces free of dust before applying first coat. In the cast of painted woodwork, fill nail and screw holes, splits and scratches, with non-shrinking filler after first coat is dry. When these occur on a surface to receive a transparent finish, use putty tinted to match local grain condition. Between coats, sand lightly with NO. 00 sandpaper and remove dust.

e. Hardware

Remove finish hardware, electric plates and accessories, mask any that are not removable. Replace these when paint is dry and clean them. Do not clean hardware with solvent that will remove permanent lacquer finish.

f. Preprimed pumps, motors, and similar equipment

Prior to painting preprimed pumps, motors, and similar equipment, remove paint protective coating such as silicone, to insure good paint adhesion.

g. Protection

1) Provide metal pans or adequate tarpaulins to protect floors in areas assigned for the storage and mixing of paints.

2) Use sufficient drop cloths and protective coverings for the full protection of floors, furnishings, and work not being painted. Protect mechanical, electrical, special equipment, hardware, and all other components of the building which do not require painting, from spot painting and other soiling during the painting process.

3) Leave above areas clean and free from evidence of occupancy upon completion of painting.

4) Protect paint materials from fire and freezing.

5) Keep waste rags in metal drums containing water and remove from building at end of each working shift.

h. Workmanship

Work shall be applied:

1) By skilled tradesmen working under direction of a capable foreman and according to manufacturer's directions

2) In a workmanlike manner, with suitable clean equipment in good condition

3) In dust-free and suitable conditions for production of best results

4) By even uniform, brush marks; free from sags, crawls, runs, or other defects detrimental to sheen, color, and texture

5) In a manner to prevent splattering or spilling over finished surfaces

I. Paint Schedule

Painting contractor must be familiar with the painting products bid and the performance characteristics of the products. Specified number of coats of paint products is to be regarded as <u>minimum</u>; bid shall include additional coats as necessary to achieve a quality installation. Consider paints/finishes that use a citrus oil solvent.

1) Priming

SURFACE	COATS	MATERIAL
Plaster	1	Oil-base sealer
Wallboard, concrete	1	Latex sealer block, concrete
Wood surfaces	1	Enamel undercoat

2) Finishing

AREA	MINIMUM COATS	MATERIAL
Walls/ceilings/woodwork-kitchen, washrooms	1	Alkyd gloss enamel
Walls/ceilings/woodwork-Service type rooms	1	Alkyd glass enamel
Doors/woodwork scheduled to be painted	1	Alkyd low-lustre Semi gloss, 34-45 sheen
Ceiling for public spaces	1	Latex flat
Walls/woodwork; corridors and stairwells	1	Alkyd semi-gloss
Hardwood floors and stairs	1	Polyurethane -stairs urethane varnish for rails and thresholds (thinned 15%)
Concrete floor sealer	1	Polyurethane
Concrete stair treads	1	An approved finish and non-slip nosing inserts
Doors and trim suitable for natural finishes	1	Urethane varnish (thinned 15%)
All exposed piping	1 1	Primer Alkyd finish

NOTE: Prefinished cabinetwork, integrally-colored stippled ceilings, etc., need not be painted.

For high humidity or corrosive environments such as pools and arenas, obtain recommendations from Paint Manufacture.

3) Exterior Schedule

SURFACE	COATS	MATERIAL
Ferrous metals	1 2	Oil alkyd primer Exterior gloss alkyd
Galvanized steel frames, doors, grilles, flashing	1 2	Galvanizing primer Exterior gloss alkyd
Painted wood doors, frames and trim	1 2	Exterior wood primers. Exterior gloss alkyd
Painted wood fascias soffits, panels, etc.	1 2	Exterior wood primer. Lead-free stain
Parking lots, car spaces numbers, directional arrows	1	Traffic paint alkyd
Lintel and shelf angles		To be galvanized and paint finished where required (exposed to view)
Concrete	1 2	Oil alkyd primer Exterior gloss alkyd

9. Acoustic Ceiling Panels

For administrative offices the following criteria should be met:

1. Sound Absorption Coefficients for stated frequencies 125HZ<.40; 250HZ<.50; 5OOHZ<.60 1,000 HZ>.70; 2,OOOHZ>.80; 4,OOOHZ>.90

2. Ceiling Attenuation Class (CAC) of 35.

3. Light Reflectance (LR) Coefficient - shall be rated .83 or better.

4. Noise-Reduction Coefficient (NRC) - shall be (.85) or better.

N. Division 10 - Specialties

1. Washroom Accessories

Provide the following in public restrooms: (verify with City's Custodial Contract Manager) Installed with accordance of all ADA standards. All items to be surfaced mounted.

a) Paper towel dispenser - Georga-Pacific Cormatic Vuall P15 Smoked plastic high capacity 13 5/8" x 13" x 9" - minimum one per washroom

b) Toilet tissue dispenser – Georgia-Pacific. FJ79T – Eclipse 9' Twin. Smoked plastic 12" x 20 ½" x 9"

c) Sanitary napkin disposal bin - one per each female water closet Rubbermaid #6140 with Rigid liner.

d) Sanitary napkin vendor - one per female washroom

e) Equip toilet compartments for the disabled with peened finish type 304 stainless steel grab bars, lengths to comply with ANSI A117.1-92

f) Liquid soap dispenser - Bobrick Impact plastic. – B-40 Classic Series

g) Shelves - one per restroom

h) Toilet partitions - use of "Resinald 87" solid plastic partitions should be considered. Ceiling or wall mounted preferred only, with self-closing stall door hinges. Provide extra blocking in the walls for solid fastening.

i) One large, continuous mirror should be provided in each restroom.

j) Faucets to be water conserving and touch- free - Zurn or Sloan.

k) Flushometers – Zurn or Sloan.

l) Hand dryers - Sloan "optimum".

m) Trash Receptacles – Rubbermaid Untouchable square container - #3569, 23 gallon capacity. Untouchable top # 2689.

2. Flagpoles

a. Use a secure system whereby flagpole cannot be lowered accidentally or by vandals.

b. Provide (if needed) three flag poles for displaying Federal, State, and City flags.

c. Flag poles are to be lighted and have timers for on/off operation.

3. Building Signage

ADA Compliant - tactile letters and braille for signs identifying public areas. Include international ADA Symbol of accessibility at restroom signs.

4. Drinking Fountains

At least one water fountain should be provided on every floor near restrooms and meet ADA criteria.

5. Fire Extinguishers

Provide ULC listed wall mounted minimum 10 lb. ABC type fire extinguishers in all service rooms. In finished areas provide extinguishers in a recessed metal or plastic cabinet.

6. Access floors - consider where possible.

O. Division 11 - New Equipment

1. Include special equipment based upon the project needs.

2. Access to all equipment shall allow ample room for maintenance.

P. Division 12 - Furnishings

1. Include special furnishings based upon the project needs

2. Provide window coverings (1 inch aluminum slot mini-blinds - Boli, Hunter Douglas or Leveler)

3. Provide recessed entry floor mats with frames. – Milliken – First appearances. Six (6) feet of walk off preferred. Comply with Ansi] A117.1-92 for changes in levels.

Q. Division 13 - Special Construction

1. Include special construction features based upon project needs

R. Division 14 - Conveying Systems

1. Elevator design shall meet the requirements of the American Standard Safety Code for Elevators, dumbwaiters, escalators, and moving walls and comply with the minimum passenger elevator requirements for the disabled. (ANSI/ASME A17.1)

2. Provide a flush-mounted communications device and handrails in the car.

3. Floor numbers on cab control panel and at the hoist way jambs shall include braille.

4. Elevator to be Kone.

S. Division 15 - Mechanical

1. Products and systems

a) All underground ductile iron pipe shall have polyethylene encasement IAW. ANSI/AWWA C105/A21.5.

b) Plumbing Fixtures: (Crane/American Standard/Kohler):

1) Water Closets shall be wall mounted or wall hung with automatic flush valves.

2) Urinals - wall type with shields Waterless urinals should be considered when appropriate. Use Falcon or approved equivalent.

3) Lavatories - 20 inch x 18 inch with automatic flush valves faucets. Comply with ADA required clearances and insulation of hot water lines.

4) Service Sinks - roll rim enameled cast-iron with trap standard, chrome strainer, front rim guard, hose end lever handle bibbs

5) Counter Sinks - stainless steel self rimming with swing spout faucet. Shut-offs on supplies

6) Refrigerated Drinking Fountains - wall hung, stainless steel basin, 8 gph of 50 Deg. F. water, shut-off on supply, ADA compliant. (OASIS; ELKAY)

7) Drinking Fountains - wall hung, shut-off on supply, ADA compliant. (OASIS; ELKAY)

8) Showers - Push Button or infra-red, vandal proof, flow restricted shower head; off push-button control. ADA accessible showers require hand-held shower heads.

c) Plumbing Accessories

1) Floor Drains - cast-iron body, 6 inch nickel bronze grate, trap primers as required

2) Clean outs - cast-iron body, nickel bronze access plate flush with floor

3) Roof Drains cast-iron body, gravel guard, removable dome, under deck clamp

4) Hose Bibbs (exterior) non-freeze flush mount wall hydrants nickel bronze face and removable key

5) Water heaters (gas-fired) - storage type glass lined (Rheem or A.O. Smith) thermometer on outlet

6) Water heating Boilers - Rheem/A.O. Smith/Raypak

d) Heating/Air Conditioning

1) Equipment

a) Oil/Gas furnaces - Lennox with spark ignition and at least 90% efficient with sealed combustion

b) Roof-top Heating/A.C. Units with economizers and relief air; CO2 sensors, high pressure and low pressure refrigerate cut-outs; crankcase heaters; and liquid line dryers

c) Gas infrared heaters - Modine/Reznor

d) Electric infrared heaters - G.E./Modine

e) Gas unit heaters - force draft units only

f) Electric heating equipment - Reznor

g) Gas heating boilers - Rheem/Raypak/Laars/Ajax

h) Fans-Quality units with bearings accessible for lubrication and maintenance

i) Pumps - Armstrong/Taco (Provide Balance Gauges both sides)

j) Controls - Compatible to Johnson Controls Metasys. (ASC controllers, DX9100).

k) Thermostats - Honeywell (T7300/Q7300 Programmable) or Johnson Controls sensors

l) Louvres/Grilles - Hart Colley/Titus

m) Radiaters/Convectors - Trane/Dunham

n) Redundancy cooling or ventilation should be considered in all computer server and PBX rooms.

2. Variable-Speed Drives
The application of inverters to air handlers, fans, pumps, etc. should be considered. Protect units from transient electrical phenomenon.

3. The installation of Halon 1301 or Halon 1211 systems or other systems using halogenated hydrocarbons is prohibited.

T. Division 16 - Electrical

1. Approved Products and Systems

The following list of products and systems shall be used for electrical work. Other products may be considered.

a. Panel boards (c/w bolt-on breakers), safety switches and disconnects - Square “D” power management capabilities. (ie, Powerlogic System) Energy monitoring accessories (Current Transducers) shall be provided for building load analysis (lighting, HVAC, misc.) or equals will be considered.

b. Power contactors - Allen Bradley or Square "D"

c. Wiring devices - Hubbell or Pass & Seymore specification grade. Use of commercial grade wall outlets and switches required.

d. Lighting

1) Types of Luminaries Typically Used

- Indirect fluorescent - Peerless
- Deep cell troffers - Lithonia; Am. Louver; Lightolier
- Lensed troffers - Lithonia; Hubbell
- Wrap-around surface fluorescent-Graybar; Hubbell
- Fluorescent wall sconces - Royalyte
- Vapor proof shower lights - Visioneering
- Downlighting - Lithonia

2) Parking Lot Lighting - Ruud; Holophane; Wide-Lite. System should include:

- HID (HPS)
- Automatic energy control system
- Cut-off light distribution

3) Ballasts

- Those located in interior spaces should have an A sound rating. All ballasts should have a high power factor (over 95%) and low THD.

- Motorola or Advance Mark VII for electronic ballasts
- Advance Mark III or GE optimizer for energy efficient magnetic ballasts
- No PCB units permitted

4) Building Exterior Lighting

- High Pressure Sodium Lamps - Phillips or G.E.
- Have automatic turn-on/turn-off

5) Provide dimmers for lights where practical - Lightolier; Lutron

6) Lamps - Philips

- Fluorescent lamps with CRI 80 or greater in occupied area
- Color temperatures: General office - 3500 K, drafting areas - 4100 K lamps
- Metal Halide lamps should have color consistency
- High CRI for HPS lamps - GE “White Lucalox”

e. Fire Alarm Systems - only non-proprietary systems

f. Emergency exit lights (Green LED) - Yorklite, or Dual-Lite.

g. Occupancy Sensors - Watt Stopper

h. Feeders shall consist of copper conductors with XLPER90 insulation run in EMT or corresponding TECk or MIT type cable run on Unistruct channel or cable tray depending upon economics. Aluminum cable shall not be specified. Rust resistant coating to be applied to all galvanized rigid conduit in direct contact with earth. Size feeders with 25% spare capacity for future. BX Flex conduit is not acceptable.

I. Grounding

- Grounded conductor shall be larger then code minimum.
- Ground rod connections shall be exothermic.
- Dedicated ground required for AC supplied to telecom room.

j. Fire alarm & Supervisory Systems - Supplier shall provide internal wiring diagrams and all information needed for owner maintenance of system.

k. Motors: units must meet current high efficiency standards.

V. Other

A. Operation and Maintenance Manual: Submit for the systems and equipment indicated in the technical sections. Furnish three copies, bound in hardback binders (8 ½ x 11 - 3 ring) or an approved equivalent. Furnish one complete manual prior to performance of systems or equipment tests, and furnish the remaining manuals prior to contract completion. Inscribe the following identification on the cover: the words "OPERATION AND MAINTENANCE MANUAL," the name and location of the system, equipment, and name of Contractor. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment. Include a table of contents and assemble the manual to conform to the table of contents, with the tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawing folded in. The manual shall include, without being limited to, the following

1. Internal and interconnecting wiring and control diagrams with data to explain detailed operation, physical location, and control of the system or equipment. Clearly ID where wiring/controls pass to other “systems”.

2. A control sequence describing startup, operation, and shutdown, including emergency procedures for fire or failure of major equipment

3. Description of the function of each principal item of equipment, giving principles and theory of operation

4. Installation and maintenance instructions/ preventative maintenance schedules

5. Safety precautions/personnel hazards

6. Diagrams, illustrations, and assembly drawings

7. Testing and trouble-shooting procedures

8. Performance data/specifications

9. Lubrication schedule including type, grade, temperature range, and frequency

10. Parts list indicating sources of supply, recommended spare parts, and name of servicing organization

11. An appendix listing qualified permanent servicing organizations for support of the equipment, including addresses and certified qualifications

B. POSTED OPERATING INSTRUCTIONS: Furnish approved operating instructions for systems and equipment indicated in the technical sections for use by operation and maintenance personnel. The operating instructions shall include wiring diagrams, control diagrams, and control sequence for each principal system and equipment. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions as directed. Attach or post operating instructions adjacent to each principal system and equipment including startup, proper adjustment, operating, lubrication, shutdown, safety precautions, procedure in the event of equipment failure, and other items of instruction as recommended by the manufacturer of each system or equipment. Provide weather-resistant materials or weatherproof enclosures for operating instructions exposed to the weather. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

C. FACILITY MANAGEMENT RECORD DRAWINGS

Provide the shown drawing layers on disks in AutoCAD format.

Additionally; include lighting and HVAC plans.