

## Table of Contents

### Section B – Structure, Building Envelope and General Building Components

|                                                             |      |
|-------------------------------------------------------------|------|
| B0010 – Building Elements Demolition.....                   | B-1  |
| B1010 – Foundations & Foundation Concrete.....              | B-5  |
| B1011 – Structural Analysis and Design.....                 | B-6  |
| B1012 – Building Super Structure .....                      | B-10 |
| B1013 – Structural Penetrations in Existing Buildings ..... | B-12 |
| B2010 – Exterior Walls.....                                 | B-13 |
| B2011 – Exterior Wall Fenestration.....                     | B-25 |
| B2020 – Roof Coverings .....                                | B-29 |
| B2021 – Roof Openings.....                                  | B-37 |
| B3010 – Doors.....                                          | B-38 |
| B3011 – Door Hardware .....                                 | B-40 |
| B3012 – Electro-Mechanical Door Hardware .....              | B-46 |
| B3020 – Painting .....                                      | B-50 |
| B3030 – Stairs and Railings .....                           | B-53 |

### Section C – Interior Construction and Finishes

|                                              |      |
|----------------------------------------------|------|
| C1010 – Interior Partitions.....             | C-58 |
| C1020 – Fixed Furnishings and Equipment..... | C-61 |
| C1021 – Interior Accessories.....            | C-64 |
| C2010 – Wall Finishes .....                  | C-67 |
| C2020 – Floor Finishes .....                 | C-68 |
| C2030 – Ceiling Finishes.....                | C-72 |

## **B0010 – Building Elements Demolition**

### **Introduction**

This section includes requirements when performing demolition activities at the University of Colorado-Boulder (UCB). The overall intent of the University is to provide safe working environments to all campus occupants during demolition activities. The consultant and/or contractor will work closely with the UCB Environmental Health and Safety (EH&S) and UCB Project Manager to review extent of demolition to ensure the safety and health of affected campus occupants.

### **UCB Requirements**

#### **1. General Demolition Requirements:**

- a. Unless otherwise identified by UCB, all demolished materials belong to the contractor.
- b. All materials or systems (including hangers, supports, and other accessories) identified to be demolished will be demolished to the point of the material or system designated to remain or the point of origin.
- c. No materials or equipment shall be abandoned in place. Remove all abandoned materials and equipment back to their source. The lack of complete demolition has resulted in a collection of abandoned in-place materials that has led to the campus having difficulties with access, maintenance and new construction activities.
- d. All abandoned materials and equipment connections within the area of work shall be removed back to their source or approved utility location, regardless of whether abandoned materials were previously existing.
- e. At a minimum, remove all abandoned materials as necessary to provide adequate clearances to install and easily maintain new construction.
- f. Remove debris, rubbish and other materials resulting from demolition operations from building site and off the campus.
- g. Coordinate noisy and vibration creating operations with UCB so that the existing and nearby functioning facilities are disturbed minimally.
- h. Ensure minimum interference with streets, pedestrian ways and adjacent facilities and ensure the safe passage of vehicular and pedestrian traffic around the site.
  - 1) Provide temporary barricades, traffic control, and other forms of protection as required.
  - 2) Provide alternate routes around closed or obstructed vehicular and pedestrian ways as routes required by UCB.
- i. Keep dust from entering existing facilities or impacting campus occupants.
- j. Existing conditions at the time of inspection for bidding purposes will be maintained by UCB as much as possible. Variations may occur by UCB salvage and asbestos abatement operations prior to start of demolition.

#### **2. Utilities Demolition:**

- a. Refer to **Campus Standard G3000** for utility demolition requirements.



3. Demolition Process:

- a. Submit schedule indicating proposed methods and sequence of operations for selective demolition work.
- b. Verify with UCB project manager whether building will be occupied or vacated during expected work activities. In many instances, UCB personnel will be continuously occupying areas of the building immediately adjacent to areas of demolition.
- c. Conduct demolition work in manner that will minimize the need for disruption of normal operations if building remains occupied.
- d. Erect and maintain dust-proof and weatherproof partitions and closures as required.
- e. Cover and protect furniture, equipment and fixtures, if not removed by UCB.
- f. Coordinate outages with UCB Project Manager.
  - 1) Provide minimum of 10-day notice to UCB of anticipated outages.
  - 2) Provide minimum of 72-hour notice of demolition activities.
- g. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

4. Selective Demolition:

- a. Removal and Salvage:
  - 1) UCB reserves first salvage rights.
    - i. Provide a schedule of items to be salvaged and clearly identify and tag which items are to be retained by UCB.
    - ii. Consultants to confirm what items will be salvaged by UCB or what materials are in condition to be re-used or donated. UCB will take ownership of salvaged materials following removal and turn-over by contractor.
    - iii. Salvage all hand dryers and dispensers and turn over to UCB Facilities Management.
  - 2) Work with UCB to determine items of historic or archaeological value.
  - 3) Items of salvageable value are property of the contractor, if not claimed by UCB.
- b. Removal and Re-Use:
  - 1) Work with UCB to determine whether salvaged materials can be incorporated into project or future campus projects.
- c. Existing to Remain:
  - 1) Protect existing to remain as identified in Demolition Process above.

5. General Environmental Safety:

- a. Comply with UCB EH&S and Colorado Department of Public Health and Environment's Air Quality Control Commission regulations for dust control.
- b. Comply with Solid and Hazardous Waste Regulations of Colorado Department of Health requirements regarding debris control.
- c. All projects on campus must obtain an Environmental Compliance Document (ECD) from UCB EH&S.
- d. Comply with CU Boulder recycling standards in Section A0022: Interface with Campus Entities.

- e. Coordinate with UCB Project Manager for building survey of ACMs and other hazardous materials.
  - 1) A copy of the environmental compliance document (ECD) is available for review from UCB.
- 6. Hazardous Material Remediation:
  - a. Confirm direction for remediation efforts with UCB EH&S when hazardous materials are discovered during the demolition process. Potential hazardous materials include:
    - 1) Mold
    - 2) Lead-Containing Material
    - 3) Mercury Containing Fixtures
    - 4) E-Waste
    - 5) Batteries
- 7. Asbestos Containing Materials (ACM) Removal Process:
  - a. Contractor's project manager/superintendent to sign and return Environmental Compliance Document stating they are advised of hazardous materials and coordination requirements.
  - b. In the event the contractor encounters material reasonably believed to be ACMs or Polychlorinated Biphenyl (PCB):
    - 1) Stop work and immediately report condition to UCB in writing.
    - 2) UCB will contract state certified asbestos general abatement contractors to complete abatement work independent of project scope.
    - 3) UCB will notify contractor when abatement work has been completed and project work can be continued.
- 8. Adjacent Conditions:
  - a. Protect existing landscaping, utilities, and structures which are not to be demolished.
    - 1) Refer to **Campus Standard G1040** for additional information pertaining to protecting existing landscape.
  - b. Prevent movement or settlement of adjacent structures, and utilities. Provide bracing and shoring as necessary.
  - c. For capital projects, jet and video storm sewers within the project site where debris may have accumulated. Coordinate with UCB Utility Services.
- 9. Waste Management:
  - a. Comply with CU Boulder recycling standards in Section A0022: Interface with Campus Entities for additional waste management requirements.
  - b. Do not use UCB dumpsters or other trash receptacles for disposal of demolition debris.

## **B1010 – Foundations and Foundation Concrete**

### **Introduction**

This section includes requirements for permissible foundation types and foundation concrete at the University of Colorado-Boulder (UCB). The overall intent is to provide suitable foundations for university construction and require contractors to provide structural concrete that is durable and provides adequate strength while allowing the installing contractor sufficient flexibility in selecting the concrete mix.

Refer to **Campus Standard B1012** for requirements pertaining to concrete used for the building super structure and **Campus Standard G2010** for concrete used for site paving.

### **UCB Requirements**

1. Permissible Building Foundations:
  - a. Drilled concrete piers
  - b. Cast-in-place concrete spread footing foundations
2. Additional Permissible Foundations (when approved by UCB):
  - a. Helical anchors
  - b. Micro-piles
  - c. Shotcrete foundation and/or above grade walls and slabs.
3. Non-Permissible Foundations:
  - a. Driven piles are not allowed due installation noise and ground vibrations from pile driving hammers.
  - b. Foundations that require a groundwater dewatering system.
4. Geotechnical Investigations:
  - a. A geotechnical investigation is required for all new buildings and building additions.
  - b. Presumptive soil design parameters of IBC-Chapter 18 may be used for non-building foundations.
5. Concrete Mix Design:
  - a. Provide concrete mix designs that meet proportioning and quality control requirements of ACI-301 for each unique intended use.
  - b. Provide concrete mix designs that provide sufficient durability requirements of ACI-301 for the intended application and existing soil corrosivity conditions.
  - c. Provide special consideration and coordinate project requirements for concrete flowability when pumped and when used in drilled pier foundations.
  - d. Provide special consideration and coordinated project requirements for concrete shrinkage testing where large concrete pours are anticipated.

6. Concrete Reinforcing:

- a. Provide minimum concrete cover defined in ACI-301 with additional consideration for increased concrete cover in concrete subject to weather, frequent de-icing chemicals and/or snowmelt systems. Coordinate proposed additional concrete cover requirements with the UCB Civil Engineer.
- b. Provide epoxy coated reinforcing in concrete supporting vehicular traffic and parking, loading docks, and other areas of frequent application of de-icing chemicals.
- c. Inspection of the placement of all reinforcing steel will be performed by UCB personnel, a third-party special inspector, or the project engineer-of-record. Coordinate with UCB Project Manager.
  - 1) Submit inspection reports to the UCB Project Manager for review and record.

7. Concrete Testing:

- a. Engineer-of-Record to identify all special inspections on the construction documents.
- b. Third-party testing of all structural concrete is required for (at a minimum) strength, air entrainment, slump, and water added at the site. UCB Project Manager will hire third-party testing agency.
  - 1) Submit test reports to the UCB Project Manager for review and record.

8. Exposed Concrete:

- a. All buildings, site walls and paving are potentially subject to de-icing chemicals. Identify suitable strategies to minimize their effects and coordinate suitable mitigation strategies with the UCB Civil Engineer on a project-by-project basis.

9. 'Board Formed' Concrete Aesthetics:

- a. Refer to **Campus Standard B1012**.

10. Under-Slab Vapor Barrier:

- a. Provide vapor barrier under all interior concrete slabs on grade. Refer to **Campus Standard B2010** for additional information.

## **B1011 – Structural Analysis and Design**

### **Introduction**

This section includes requirements for structural analysis and minimum design standards for University of Colorado-Boulder (UCB) buildings that are not already defined in adopted building codes and other documents commonly used as industry standards.

UCB requires consistency in defining structural design criteria on the structural design drawings because of the inevitable remodels and modifications to the structure that will occur during the desired lifespan of a campus building and the corresponding need to re-evaluate the structural capacity for changes in

building use. Use the design criteria identified in this section to meet the minimum strength and serviceability requirements suitable for UCB buildings and uses.

### UCB Requirements

#### 1. Reference Standards:

- a. Building Risk Category:
  - 1) Risk Category-I is not allowed unless approved in advance by the UCB Civil Engineer.
- b. Wind Loads:
  - 1) All UCB buildings fall within a 'special wind region' defined by ASCE 7. Utilize the wind speeds defined by the 'Special Wind Zone Map of Factored Wind Speeds' published by the *Structural Engineers Association of Colorado (SEAC)*. Wind speeds will vary between Main, East and South Campuses and the Mountain Research Station.
- c. Additional considerations:
  - 1) Consider Building Risk Category when using the 'Special Wind Zone Maps' and summarize risk category used in design on the structural design drawings.
  - 2) Use Building Exposure Category 'C' unless further investigation warrants a reduced upwind exposure category. Summarize Building Exposure Category used in design on the structural design drawings.
  - 3) Consider topography factors for wind and summarize  $K_{zt}$  factor used in design on the structural design drawings.
  - 4) Air Density:
    - i. In calculating velocity pressures for Main Wind-Force Resisting Systems (MWFRS) using chapter C27 of ASCE 7, the numerical constant 0.00256 may be reduced to account for site specific air density. Reduction shall comply with ASCE 7, but in no case, shall the reduction in the numerical constant exceed fifteen percent (15%). If used, summarize the air density reduction factor used in design on the structural design drawings.
  - 5) Wind tunnel testing for wind load determination of new capital construction building projects is allowed but discuss and coordinate in advance with the UCB Civil Engineer.
  - 6) Wind uplift loads on post-installed roof support solar PV arrays may be determined using IBC wind requirements, wind tunnel testing or other published rational methods when approved in advance by the UCB Civil Engineer (for example, the document "*Solar PV-2*", published by the Structural Engineers Association of Northern California (SEAoNC)).
- d. Snow Loads: For buildings on the Main, East, South, and Williams Village Campuses, the minimum ground snow load is  $p_g = 40$  PSF and the minimum flat roof snow load is  $p_f = 30$  PSF. For all other areas, including the Mountain Research Station, refer to provisions set forth by the Snow Load Maps published by the *Structural Engineers Association of Colorado (SEAC)*.

2. Assessing Existing Structures:

- a. Within their lifespan, UCB buildings will undergo several remodels as space is reassigned to different users with varying occupancies, uses and associated structural loading. Compare the loading criteria of the original design with the new load demands and verify if additional structural strengthening is required.
- b. All buildings, site walls and paving are potentially subject to de-icing chemicals and needs to be considered when assessing existing structures. Concrete repairs and strengthening may be required to compensate for loss of section through corrosion over time.
- c. The use of chemical adhesive anchors to support gravity loads is known to exist in portions of remodeled buildings. While this condition is not present throughout the campus, these chemical adhesive anchors will affect renovation work where discovered. At the time when these connections were installed it was acceptable and common practice, however, based on further research, it was learned that chemical adhesive anchors are susceptible to capacity reductions when the anchors are subjected to sustained heat from a fire. The University desires to eventually replace all such discovered connections on a case-by-case basis. Immediately notify the UCB Civil Engineer when such anchors are discovered in the process of assessing and renovating an existing building.

3. Frost Line Depth:

- a. For buildings on the Main, East, South, and Williams Village Campuses, identify a minimum frost line depth of 32". For all other areas, including the Mountain Research Station, refer to provisions set forth by Boulder County or as recommended in the project Geotechnical Engineering report.

4. Minimum Floor Live Loading:

- a. To account for future flexibility and remodeling, design all floors of non-residential buildings for a minimum of 80 PSF uniform live load unless a greater amount is required based on occupancy or use in ACSE 7.

5. Permissible Serviceability Deflection Criteria:

- a. Limit deflections to criteria defined in IBC unless more stringent limits are required for finishes, building use, and other criteria established by the UCB Civil Engineer at the start of the project.
- b. Special deflection limits for exterior walls:
  - 1) For exterior walls constructed of sandstone masonry veneer and/or brick masonry veneer backed by cold formed light gauge steel stud framing, limit the calculated deflections of the bare steel studs to  $H/600$  using 70% of the MWFRS wind pressures of the 50-year wind event. Base the strength calculations for the steel stud framing on the full MWFRS wind pressures.

6. Vibration Design Criteria for New Buildings and Remodels:

- 1) For all steel-framed buildings and unless superseded by the vibration consultant's project specific recommendations, vibration analysis shall conform to *Design Guide-*

- 11, published by the American Institute of Steel Construction, and other current industry standard guidelines.
- b. At the start of the project, verify with the UCB Civil Engineer on whether a vibration consultant will be required to be consulted to analyze overall building structure response to vibrations and specific placement and isolation of machinery and equipment with moving parts. The use of a consultant specializing in vibration analysis and control may be required for both new construction and renovations.
  - c. Summarize all vibration criteria used in design on the structural design drawings.
  - d. Where possible, position vibrationally sensitive equipment in areas of the building to minimize effects of ancillary floor vibration sources.
  - e. Coordinate vibration criteria of general office spaces, classrooms and computer lab spaces with the UCB Civil Engineer during the Schematic Design phase of the project.
  - f. Coordinate vibration criteria of laboratory and sensitive research areas, where optical microscopes or other similarly sensitive equipment will be operated, with the vibration consultant (if applicable). Consider anticipated foot traffic walking speeds within and adjacent to the research lab space.
  - g. Design precision instrument spaces according to the sensitive equipment manufacturer's recommendations. Consider the effects of adjacent equipment, other sources of vibration, and facility operations.
7. Vibration Control on Mechanical Equipment:
- a. Provide vibration isolation devices to limit equipment-induced vibrations to the structure on which the equipment is supported or attached.
  - b. Coordinate the vibration isolation devices with the mechanical engineer, equipment supplier and vibration consultant (if applicable) and for each piece of equipment identify the equipment-induced vibrations to the structure on the structural design drawings.
8. Re-Roofing Alterations of Existing UCB Buildings:
- a. Consult with the UCB Civil Engineer as to which portions of IEBC are appropriate for the specific project.
9. Construction Documentation:
- a. Define the governing building code(s), reference design standards, deflection limits, dead loads, live loads, wind loads, seismic loads, vibration design criteria and any other relevant design criteria which may be useful for future building remodels on the structural drawings.
10. Solar Photo-Voltaic (PV) Systems:
- a. Provide project-specific design documents of roof-mounted PV systems, stamped and signed by a Colorado registered Professional Engineer.
11. Embedded Conduit:
- a. UCB cautions against embedding conduit within horizontal structural elements, even if such conduit is incorporated into the structural analysis. UCB experience indicates significant

practical problems with overlapping conduit and large concentrations of conduit which cannot be accurately accounted for in the design phase.

## **B1012 – Building Super Structure**

### **Introduction**

This section includes requirements for selecting structural systems for buildings at the University of Colorado-Boulder (UCB).

The overall intent of UCB is to provide structural systems that meet the initial program requirements as well as being reasonably adaptable for unforeseen future uses, new program requirements, new equipment and new users.

### **UCB Requirements**

1. Permissible Structural Systems:
  - a. Cast-in-place concrete basement walls and retaining walls.
  - b. Cast-in-place concrete slabs-on-ground, slabs-on-void, structural slabs, columns, beams, joists, waffle slabs and interior structural walls.
  - c. Cast-in-place concrete poured over metal deck.
  - d. Cast-in-place concrete exposed exterior building walls.
  - e. Pre-cast structural and architectural concrete (interior or exterior).
  - f. Steel-framed buildings; including beams, columns, lateral bracing and roof joists.
  - g. Reinforced concrete unit masonry (CMU) walls, either fully or partially grouted.
2. Additional Permissible Structural Systems (when approved by UCB):
  - a. Post-tensioned concrete slab and beam systems (considered for parking structures).
  - b. Steel joists used in floor framing (subject to fire protection and floor vibration requirements).
  - c. Shotcrete foundation or above grade walls and slabs.
3. Non-Permissible Structural Systems:
  - a. Post-tensioned concrete slab and beam systems for academic or residential buildings.
  - b. Wood framed buildings, walls, floors or roofs.
  - c. Pre-engineered steel buildings; including light-gauge steel framed modular systems. Bike or bus-stop shelters may be exempted from this requirement, check with UCB Project Manager.
  - d. Tilt-up cast-in-place concrete wall systems.
4. Adaptability of Structural Systems:
  - a. Evaluate the cost premium for future flexibility of the proposed structural systems during the Schematic Design phase.

- b. Discuss alternative framing systems with the UCB Civil Engineer prior to making the final system selection.
- 5. Roof Structure:
  - a. Campus preference is to slope the roof framing of a building rather than providing a flat roof structure and accomplishing roof drainage with tapered rigid insulation.
  - b. Design the roof structure of all buildings two stories and taller to accommodate OSHA compliant fall protection systems and roof tie-off points and incorporate IBC Deferred Submittal requirements into the construction documents. Provide final design drawings, stamped and sealed by a Colorado registered Professional Engineer.
  - c. Antennas/Solar Panels/Miscellaneous Post-Construction Installation:
    - 1) Provide project specific design documents of any support and connections to the primary building structure, stamped and sealed by a Colorado registered Professional Engineer.
- 6. Certified Fabricators and Erectors:
  - a. For steel-framed structures, consult with the UCB Civil Engineer following Design Development whether AISC Certified Fabricators and/or erectors are required.
  - b. For pre-cast structures, consult with the UCB Civil Engineer following Design Development whether PCI Certified Fabricators and/or erectors are required.
- 7. Masonry Veneer Ties:
  - a. Provide veneer ties of sufficient strength taking into consideration the increased cavity dimensions of continuous insulated envelope designs.
- 8. Concrete Mix Design and Reinforcing Requirements:
  - a. Refer to **Campus Standard B1010**.
- 9. Quality Control Testing and Inspection:
  - a. Engineer-of-Record shall identify all required special inspections.
  - b. Third-party testing and special inspection shall be performed on all building super structure elements in accordance with the project's QA/QC plan and as approved by the UCB Civil Engineer. UCB Project Manager will hire third-party testing agency. Submit inspection and testing reports to the UCB Project Manager for review and record.
- 10. Exposed or 'Board Formed' Concrete Aesthetics:
  - a. Obtain approval from the UCB Campus Architect for board-formed exposed concrete and proposed concrete form liners.
  - b. Refer to **Campus Standard A0020** for mock-up expectations. Confirm with the UCB Landscape Architect whether mock-ups will be required for landscaping site walls.

## **B1013 – Structural Penetrations in Existing Buildings**

### **Introduction**

This section includes requirements for evaluating existing structural walls and floors to receive new penetrations during a renovation at the University of Colorado-Boulder (UCB).

The overall intent of UCB is to ensure new wall and floor penetrations do not reduce the structural capacity of the existing building into which they are added. Even small penetrations installed in the wrong location in the building structure can have serious structural consequences up to and including structural failure.

### **UCB Requirements**

#### **1. UCB Review:**

- a. No floor, wall, or foundation/grade beam penetrations may be installed without prior review and approval of the UCB Civil Engineer.
  - 1) Penetrations through non-load bearing light-gauge steel-framed interior partition walls can be installed without UCB review.
- b. Provide the locations of the proposed penetrations to the UCB Civil Engineer to review and assess whether further structural evaluation is required by a structural engineer.

#### **2. General Penetration Requirements:**

- a. Prior to penetrating a floor or wall, scan the existing structure with a Pacometer, Ground Penetrating Radar (GPR) or other suitable method to locate existing reinforcing in the vicinity of the proposed opening. Identify the proposed location of the penetration on the reinforcing 'map' to determine if the proposed location is acceptable or if the penetration will need to be shifted to clear critical reinforcing or structural members.
- b. The cutting of any existing reinforcement is not acceptable without review and approval by UCB and a structural engineer. Indiscriminately cutting through reinforcing to install penetrations without prior structural consideration is not acceptable as it could cause structural failure of the floor, roof or wall.
- c. Where possible for smaller openings, hammer drilling is preferred over core drilling to minimize accidental cutting of the concrete reinforcing. Confirm desired method with UCB.
- d. Once determined that a penetration size and location is acceptable:
  - 1) For circular penetrations, install by hammer-drilling or core-drilling.
  - 2) For rectangular penetrations, install by hammer drilling or core-drilling the four corners, followed by saw-cutting between the corners. Overcutting at the corners is not acceptable.

#### **3. Concrete Slab-on-Grade:**

- a. These floor penetrations are generally acceptable, unless the slab-on-grade also functions as a concrete "lid" spanning over a below-grade utility tunnel. If a basement-level floor penetration is to be installed in a slab "lid" over a utility tunnel, it should be evaluated as if it were a structural slab (see below).



- b. Floor penetrations through concrete slabs-on-grade may be placed with significant freedom, although multiple penetrations in close proximity are not acceptable.
  - c. Floor penetrations where high ground water level is present must adequately seal penetration from potential water intrusion
- 4. Structural Concrete Flat Slabs:
  - a. Installing new floor penetrations in concrete flat slabs (with primary reinforcing in two directions) requires a more refined evaluation than installing the same size floor penetration in a one-way concrete system (with primary reinforcing in one direction only).
  - b. Consider all slab reinforcing to be 'primary' structural reinforcing. No reinforcing is considered secondary or nonstructural.
  - c. Subject to review by a structural engineer, general locations of floor penetrations should be at least 36" from the face of an adjacent building column.
  - d. Avoid clusters of closely spaced openings without exception. New floor penetrations should not exceed 6" in diameter without further review by a structural engineer. Generally, new openings should be spaced at least 36" apart.
  - e. Enlarging an existing floor slab penetration by reaming a larger diameter hole through the previous hole is generally acceptable, subject to review by a structural engineer.
- 5. Concrete Slabs Supported by Concrete Joists/Beams or Steel Beams:
  - a. Generally, new floor penetrations may be installed through the slab portion between the joists.
- 6. Concrete Waffle Slabs:
  - a. Generally, new floor penetrations may be installed through the slab between the waffle slab joist ribs.
- 7. Structural Wall Penetrations:
  - a. Wall penetrations require evaluation of the wall construction and lintel design.
  - b. Install lintels prior to cutting the wall penetration.

## **B2010 – Exterior Walls**

### **Introduction**

This section includes requirements when designing exterior envelopes for the University of Colorado-Boulder (UCB). The intent is to guide the design consultant in creating highly efficient exterior envelopes which aesthetically complement and reflect the architectural heritage of the campus. Cutting and patching should be performed in a manner where new materials match existing in material, color and texture to maintain the original aesthetic of the building.

### **UCB Requirements**

1. Architectural Precast Concrete:



- a. Comply with applicable standards published by the Precast/Prestressed Concrete Institute (PCI).
  - b. Due to freeze thaw issues, verify that proper air entraining mixture is specified.
  - c. Color:
    - 1) Match existing precast concrete on existing campus buildings.
    - 2) Architectural Precast Concrete that mimics the color and appearance of Limestone may be considered in lieu of typical Limestone applications as approved by UCB.
  - d. Provide factory applied water repellent coating and touch-up on-site as necessary.
    - 1) Include sealer coat on submitted sample.
  - e. Refer to **Campus Standard A0020** for mock-up requirements.
2. Cast-in-Place Concrete:
  - a. Refer to **Campus Standard B1012** if 'Board-Formed' requirements are needed for exposed cast-in-place concrete.
  - b. Water repellent coating is required for all cast-in-place concrete surfaces.
3. General Masonry:
  - a. Comply with applicable standards published by The Masonry Society (TMS) and the Masonry Standards Joint Committee (MSJC).
  - b. Use solid units for top course of exterior piers, walls, windowsills, etc.
  - c. Use solid units for soldier courses in bearing walls and wherever cores of hollow units would be exposed to view or weather.
  - d. Tool exposed joints to slightly concave surface.
  - e. Because of the material's porous nature, exposed exterior CMU is not permitted unless approved by UCB.
  - f. Provide masonry and stone details drawn in a way to provide proper drainage and weeping. Details will ensure minimal moisture absorption and accumulation at the wall base or any horizontal bearing surface.
  - g. When cutting and patching, use like materials and provide 2-3 sample to the UCB Campus Architect for approval.
  - h. Mortar/Grout:
    - 1) Provide colored mortar for both stone masonry and face brick veneers. Submit 2-3 mortar samples for consistency and aggregate for approval by UCB. Mortar smear wash approval must be approved by UCB Campus Architect.
    - 2) If the existing mortar type is unknown, a mortar analysis is required when performing any repair/maintenance on existing masonry where mortar type is not known.
    - 3) For consistency, provide pre-mixed mortar with color included.
    - 4) Antifreeze agents or accelerators are not acceptable, unless contractor identifies compelling reason to incorporate into work and obtains UCB approval.
4. General Masonry Accessories:
  - a. Additional information on flashings and sheet metal is identified in **Campus Standard B2012**.

- b. Provide flexible metal thru-wall flashings.
    - 1) Provide all flashing materials and accessories as an integrated system.
    - 2) Start flashings 1/2" from outside face of wall.
    - 3) Set flashings in a bed of mastic.
  - c. Weeps: Provide polypropylene cell vent, plastic tube or other materials compatible with flashing systems.
5. General Stone Masonry:
- a. Exterior masonry veneer on the Main Campus will generally be of native sandstone. Limestone is intended to be used for trim applications, including headers, sills, banding, bases, etc.
    - 1) Limestone trim depth usually interrupts exterior insulation at fenestration. Design teams must design details to maintain continuous insulation up to window framing.
  - b. Consider water absorption properties when selecting stone. UCB has had issues with stone breaking down due to water absorption and wicking action.
  - c. When cutting and patching, use like materials and provide 2-3 sample to the UCB Campus Architect for approval.
  - d. Qualifications:
    - 1) Stone installer is required to be pre-qualified prior to bidding on the project. Contractor to provide potential stone masonry installer list to UCB prior to bidding.
  - e. Do not provide water repellent coating on stone surfaces.
  - f. Control Joints:
    - 1) Provide 1/8" stone masonry veneer control joints, saw cut after stone is laid.
6. Sandstone Masonry:
- a. Color/Finish:
    - 1) Obtain from Lyons Sandstone rock formations to match in color, size, and texture of existing campus buildings.
    - 2) Select stone consistent in color range and texture with existing campus buildings within the context of the project.
    - 3) Verify selected stone is available in quantities to complete the project in consistent color range and texture.
    - 4) Provide samples from quarries intended to be incorporated into project for UCB approval.
    - 5) Submit table indicating stone color selection, mix percentage, and maximum and minimum heights.
      - i. Coordinate table with proposed stone dimensions and descriptions with the drawings. Drawings must include a set of standard details based on details identified in **Diagrams B2010.1 – B2010.4**.
    - 6) Black staining is not acceptable.
    - 7) Shiners:
      - i. Provide honed or split face finish as approved by UCB. Provide thickness appropriate to size.

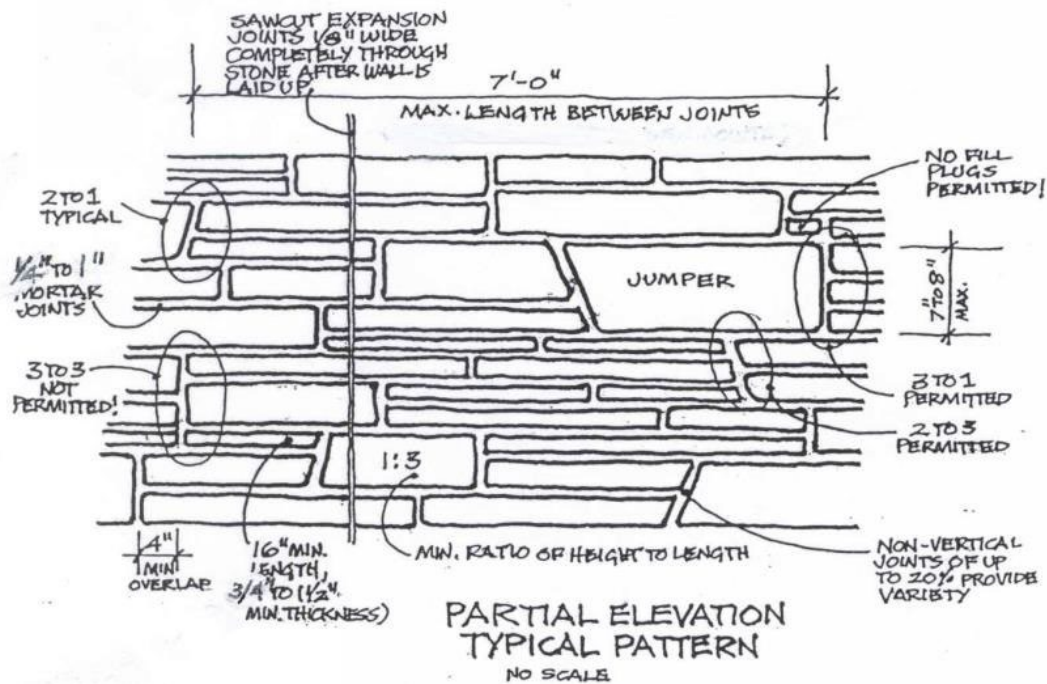


- b. Stone Dimensions and Configuration:
  - 1) Provide stone lengths minimum three times the height; maximum 7'-0" length.
  - 2) Projections:
    - i. Cut stone 5" deep (tolerance of +2" to -3/4") to allow for 1" to 1-1/2" average face projection. Newer buildings allow greater than 2" projections.
    - ii. Clip 60% of sandstone units on both ends for an average projection of 1" to 1-1/2" from face of wall. Cut stone at building corners to a straight vertical line from top to bottom of wall. Newer buildings are projecting more than 2".
  - 3) Shape stone to fit each other, knock off weak portions to bring stones to even bearing.
  - 4) Jumpers:
    - i. Avoid height dimensions more than 7" to 8". Longer patterns keep height shorter.
  - 5) Shiners:
    - i. Provide thickness appropriate to size.
- c. Installation:
  - 1) Refer to **Diagrams B2010.1 – B2010.4** for graphic representation of installation guidelines.
  - 2) Lay stone veneer with minimum 1/2-inch slush mortar fill behind.
    - i. Provide drainage mat system between continuous exterior insulation and mortar fill.
    - ii. Provide continuous air barrier/vapor retarder on back-up substrate behind slush in-fill.
  - 3) To meet the drainage intent, a cellular fabric drainage system shall be used in conjunction with stone to provide a drainage path.
  - 4) Pattern/Coursing:
    - i. Maintain pattern consistency throughout building.
    - ii. The general pattern is to be '(2) against (1)', a few '(3) against (1)', and some '(2) against (2)'. No '(3) against (3)' will be permitted.
    - iii. Lay stones on natural flat beds in horizontal courses.
    - iv. Lay native face stonework from outside face of walls.
    - v. Provide 4" minimum overlap in coursing.
  - 5) Joints:
    - i. Width/Height: 1/4" to 1"
    - ii. No continuous horizontal joints exceeding 7' in length.
    - iii. No continuous vertical joints exceeding 12" in height.
    - iv. Provide both straight vertical and angled head joints.
      - a. 20% of head joints may be angled.
    - v. Work all joints so that all joints are in the same plane.
  - 6) Perform final trimming and splitting on-site.
- d. Construction Scheduling:
  - 1) Contractor will provide a planning schedule for purchase, storage and delivery.

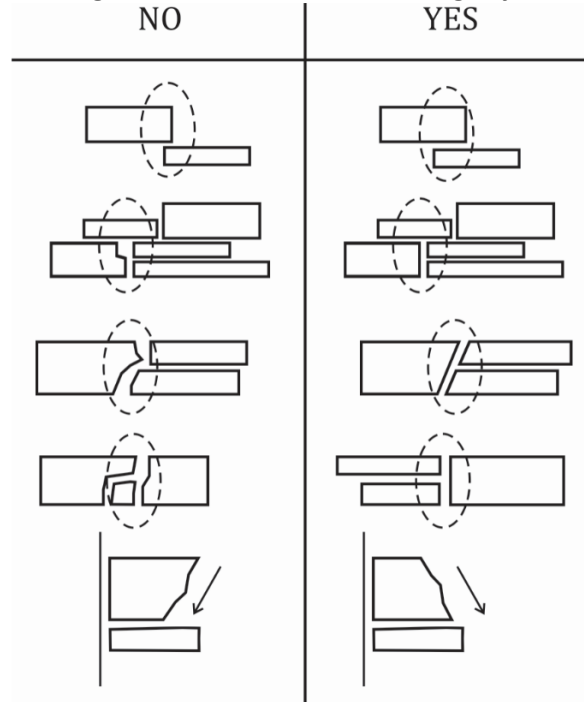


- 2) Contractor will need to plan accordingly to secure and store appropriate quantities of materials.
- 3) Stone may need to be purchased a season ahead of work being planned.

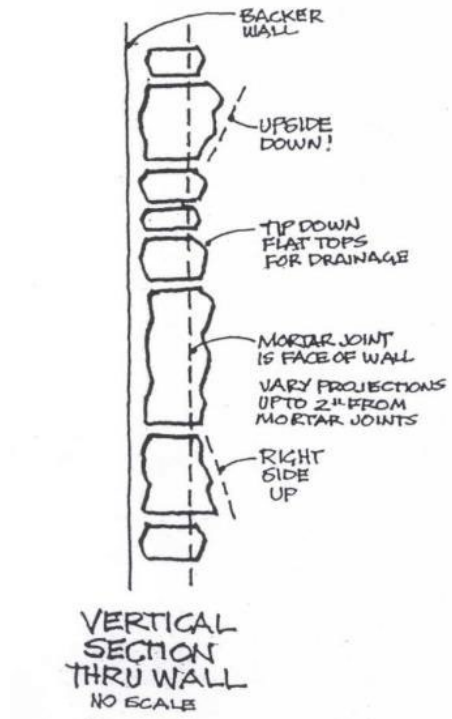
**Diagram B2010.1 – Stone Stacking Layout**



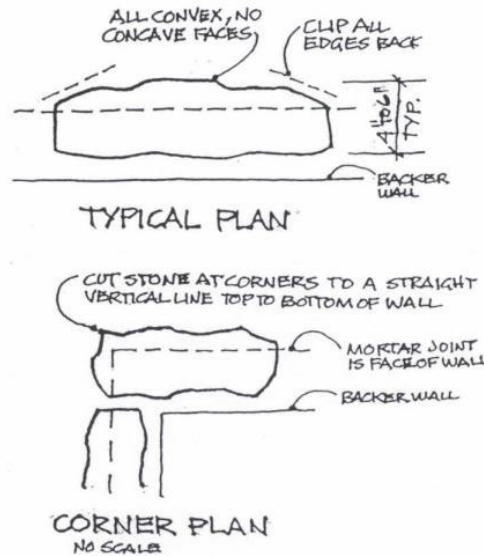
**Diagram B2010.2 – Stone Stacking Layout**



**Diagram B2010.3 – Stone Profile**



**Diagram B2010.4 – Stone Plan Details**



7. Limestone Masonry:
  - a. Reference Standard: Indiana Limestone Institute of America
  - b. Provide variegated limestone color and honed finish to match existing campus buildings.
8. Stone Site Walls and Caps:
  - a. Match masonry veneer and finishes to adjacent new construction and/or existing buildings.
  - b. Provide precast concrete or limestone cap.
  - c. Slope caps and apply water repellant to minimize freeze/thaw deterioration.
  - d. A flashing and weeping system must be installed under cap stones so water is managed away from the site stone wall.
  - e. Provide structural engineering for any retaining site walls.
  - f. Waterproofing:
    - 1) Provide waterproofing membrane under cap and extended down both sides of site wall structure.
  - g. Provide skateboard deterrents on all horizontal site wall surfaces to match existing campus installations. Coordinate specified deterrent with UCB Landscape Architect.
9. Brick Veneer:
  - a. Provide face brick veneer colors, patterns, and texture to match existing brick on campus. Submit for approval by UCB.
  - b. For color consistency, obtain all face brick units from the same firing or run of one manufacturer.
    - 1) Provide specialty bricks in the same range of color and texture as the adjacent field brick.
  - c. Provide 'Modular' size bricks, unless the intent is to match a specific existing campus building(s).

- d. Lay bricks in a running bond pattern.

10. Exterior Metal Panel Cladding:

- a. Provide pre-finished metal panels or metal composite panels for cladding, rain-screen, spandrel, penthouse, or equipment screening applications. Submit color and profile for approval by UCB.
- b. Provide Metal Panels in thicknesses that meet the following criteria:
  - 1) Resist deformation due to wind loading.
  - 2) Resist visual 'oil-canning' following installation.
  - 3) Resist campus pedestrian traffic (dings and dents from backpacks, skateboards, bicycles, etc.)
  - 4) Resist campus maintenance duties (landscaping, lawn mowing, equipment maintenance, etc.)
- c. Equipment Screening:
  - 1) Provide pre-finished metal panels.
- d. Cladding and Penthouses:
  - 1) Provide aluminum composite panel (ACM) or prefabricated insulated metal panels.
- e. Spandrel:
  - 1) Provide ACM with back-pan system integrated into fenestration framing system.
  - 2) Spandrel panels should be insulated to the same requirements as exterior walls.
- f. Soffits:
  - 1) Metal panels are preferred for exterior soffits over stucco or direct applied systems as access panels can be integrated easier into the design.

11. Decorative Spandrel Panels:

- a. Provide metal panels, fiberglass panels, or inset stone panels to match existing campus installations. Confirm design direction with UCB.

12. Exterior Insulation and Finish Systems (EIFS):

- a. EIFS systems are not allowed on campus.

13. Exterior Stucco Systems:

- a. Stucco systems are typically not allowed on campus unless approved by UCB.
  - 1) Potential locations include equipment wells; however, metal panel is preferred because of the ease of which the panel can be removed to locate leaks and/or replace flashings.
- b. Areas completely covered and not exposed to weather may be considered for stucco applications.

14. General Exterior Thermal Performance and Air/Moisture Control:

- a. Thermal performance values have been studied by UCB with prior energy modeling and calculations and provide the basis of thermal performance criteria listed. Consultants are expected to review the standards listed with most recent building and energy codes and suggest strategies to meet or exceed UCB thermal performance requirements.



- b. Consultants are expected to work with UCB Planning and UCB Engineering to develop typical wall details to minimize thermal bridging for the following areas: relieving angles, curtain walls, corner framing, and wall/roof intersections.
- c. Coordinate design with exterior thermal and air/moisture control performance criteria identified in **Campus Standard A0020**.
- d. Design teams shall follow the 'perfect wall' assembly unless building type and application require a different assembly.
- e. Design exterior envelope assemblies to ensure condensation/dew point is on the outside of the air/moisture control layer. Provide proven complete insulation and moisture control assemblies.
  - 1) Provide submittal to UCB indicating entire proposed systems and accessories. Include contact information for each product's manufacturer and confirmation from each manufacturer confirming compatibility of their product in relation to the entire proposed system.
- f. Verify construction drawings contain critical details for intersections of walls, roofs, floors, and building penetrations. Air barriers, insulation, vapor control layers, and water control layers need to be continuous. Identify continuity of all control layers throughout the enclosure to eliminate thermal bridging and thermal comfort problems.
- g. Where applicable, provide detailed drawings that identify strategies to address the following and review with UCB:
  - 1) Continuous insulation installed around structural elements of balconies and overhangs.
  - 2) Structural insulating element at slab edges and beam transitions or fluid-applied thermal break coating.
  - 3) Insulate above-grade floor slabs, support and support crossbeams where underside is exposed to the weather or unheated space.
  - 4) Insulate exposed exterior building columns and beams from the interior at the same R-value rating as for walls.
- h. Contractor Responsibility:
  - 1) Confirm to UCB that all installers are certified (as applicable to the material being installed), properly trained, and have the required experience to work on the specified exterior envelope system.
  - 2) The general contractor needs to pay close attention to which trade is responsible for installing materials of which they are trained.
- i. Refer to **Campus Standard A0020** for installer qualification requirements.
- j. Air Infiltration/Leakage:
  - 1) Vapor drive by means of air infiltration and air leakage is a major concern regarding exterior envelope assemblies.
  - 2) Several existing buildings have not performed testing for air leakage, even for critical buildings including labs, ice rinks, cleanrooms, and other spaces requiring humidity control. Several buildings are dealing with large air leakage resulting in poor temperature, and poor pressure or humidity control and not meeting UCB expectations. Study project specific conditions, considering areas of high humidity within the building.

- 3) UCB baseline measurement for maximum acceptable air infiltration/leakage is .25 cfm/ft<sup>2</sup> @ 50 Pa, however, the design consultant is expected to review and revise requirement to suit specific project goals as necessary.
  - i. Confirm specified maximum measurement with UCB.
- 4) Specify the testing method (air infiltration test, smoke test, thermal imaging, etc.) to identify compliance with air infiltration requirements.
  - i. Confirm selected testing method with UCB.
- 5) Remediation work will be required if air infiltration/leakage requirements are not met.
- k. Design exterior wall base transitions to ensure water is not wicked up through the concrete foundations or slabs. The campus has had issues with corrosion of studs and saturation of stud cavity insulation.

15. General Waterproofing, Damp Proofing, Air Barriers and Vapor Retarders:

- a. Comply with applicable standards published by ASHRAE, Air Barrier Association of America (ABAA) and the Building Science Corporation (BSC).
- b. Many older buildings on the campus do not have below slab vapor retarder or foundation waterproofing. For renovation projects, design teams must investigate how to waterproof or manage moisture migration for existing foundations and slabs.
- c. Provide a complete system designed to prevent the penetration and/or lateral migration of water into building.
- d. Provide products from one manufacturer, unless approved by UCB.
- e. Where multiple manufacturer's products are approved for use, verify compatibility of materials when used in conjunction with one another. Provide certification from the manufacturers indicating compatibility with other proposed products prior to the installation of the product.
  - 1) Provide accessories including expansion joints, primers, fillers, sealers, joint tapes, and other items recommended by the manufacturer of the primary waterproofing system.
- f. Submit properties of entire system including complete manufacturer's product data for testing, installation instructions, and details. Provide manufacturer's certificate that installed materials meet project requirements.
- g. Base the selection of sub-grade foundation damp proofing, waterproofing or vapor barriers on the project-specific Geotechnical Report.
- h. In the Construction Documents, provide drawings including penetrations, sheet layout, special conditions and details not standard with the manufacturer.
- i. A Horizontal Surface Flood Test may be required; verify with UCB.
  - 1) Prior to placing of the finish concrete slab on horizontal surfaces:
    - i. Perform 1" deep minimum flood test for 48 hours.
    - ii. Plug drains and place barriers to contain the water.
    - iii. Prior to test, provide 24-hour notification to UCB, Design consultant and Fluid-applied membrane manufacturer.

16. Underslab Vapor Barrier:

- a. Provide underslab vapor barrier at all interior concrete slab-on-grade installations.

17. Waterproofing:

- a. Provide continuous perimeter waterproofing system around all elevator pits and conditions where usable space is sub-grade.
- b. Specify protection of waterproofing system as recommended by the waterproofing system manufacturer.
- c. Sheet Membrane Waterproofing:
  - 1) Reference Products:
    - i. Bituthene; GCP Applied Technologies
    - ii. Jiffy Seal; Protecto Wrap
    - iii. Miradri; by Carlisle
    - iv. Polyguard; Polyguard Products, Inc.
  - 2) Use of PVC, Hypalon or EPDM sheet systems is not allowed unless approved by UCB.
- d. Fluid Applied Waterproofing:
  - 1) Reference Products:
    - i. Hydrotech 6125 System; Hydrotech
    - ii. Scotch Clad Brand Water Containment System; 3M Co.

18. Damp Proofing:

- a. Provide continuous perimeter damp proofing system at sub-grade conditions where usable space is not present.
- b. Specify protection of damp proofing from damage during backfill operations.
- c. Apply damp proofing system to steel columns and base plates to within 1" of finish floor line at grade.

19. Sheet Membrane Air/Vapor Barriers and Retarders:

- a. Provide a complete and continuous system affecting the air and water vapor movement between interior and exterior of building envelope, and provide a continuous seal to other components, such as roofing membranes, that function as air barriers.
- b. Provide field-installed fluid-applied membrane or factory-applied sheet membrane on outer sheathing or insulation drainage plane because sheet applied air barriers are prone to getting ripped or torn during construction and are difficult to seal to structural members.

20. Water Repellents:

- a. Submit laboratory test results for water repellents simulating project conditions.
- b. Delay application of water repellents until installation of sealants has been completed.

21. Joint Sealers:

- a. Seal joints with appropriate flashings and membranes within the joint and consider the outermost joint sealant as an aesthetic treatment. Provide samples to UCB for approval. Typically design teams choose too light of color when specifying sealant colors.
- b. Replacement of existing joint sealants fully remove old and install a closed cell backer rod

- c. The design of exterior joints should not rely on the joint sealer as the final line of protection between exterior and interior environments.
- d. Options for detailing expansion/seismic joints involving sandstone masonry should be reviewed with UCB during design.
- e. Design consultant drawings and specifications to indicate typical locations including but not limited to: joints between dissimilar materials, joints in cast-in-place and precast concrete, masonry control joints, roof flashing and counterflashing, penetrations of floors, walls and roofs, expansion joints, and door, window and louver frames., etc.
  - 1) At joints in vertical planes on exterior of building and interior face of through expansion or control joints, provide non-sag type polyurethane or silicone sealant.
  - 2) Apply continuous sealants at the top and bottom of stud walls for all exterior walls.
  - 3) At joints in horizontal planes on interior and exterior of building, provide self-leveling type polyurethane sealant.
  - 4) Set all thresholds in full bed of urethane type caulking.

## 22. General Envelope Insulation:

- a. Exterior Walls:
  - 1) Achieve minimum R-value of R-19 for continuous insulation.
- b. Roof Assemblies:
  - 1) For new construction, achieve minimum R-value of R-38 for continuous insulation above deck.
  - 2) For existing or renovation, provide minimum R-value of R-30 for continuous insulation above deck on existing roof assemblies.
- c. Perform a life-cycle analysis for insulation selection considering degradation of insulation R-values over time and up-front costs to achieve required R-values long-term.
- d. Achieve the required R-value in the depth of exterior continuous insulation as much as possible to minimize thermal bridging through framing members.
  - 1) Additional depth of insulation may require engineered thermally broken masonry anchors or other cladding attachments.
- e. Where insulation is used within the stud spaces:
  - 1) Provide spray insulation as a means of minimizing air infiltration. Spray insulation is not a panacea for filling holes. Better attention to detail, quality control, and setting performance goals for air leakage ensure compliance.
  - 2) If spray insulation is not used, provide stone wool insulation as stone wool maintains shape over time.
- f. Foam insulation breaks down over time and R-value is reduced. Consultants, when beginning renovation projects, verify with UCB Project Manager if it is necessary to study the current thermal performance of the existing envelope. If a study is requested, balance the long-term energy goals of the building with the cost implications of disturbing existing exterior assemblies and provide report to the UCB.
  - 1) Any building built prior to the year 2000 should have insulation added to the existing stud cavities whenever practical and approved by UCB.
- g. Unacceptable Materials:
  - 1) Un-faced or kraft-paper faced fiberglass batt insulation.

- 2) Because of the tendency to break down due to moisture absorption, Expanded Polystyrene (EPS) is not acceptable.

23. Spray Foam Insulation:

- a. Provide required thermal or ignition barrier separation if spray foam insulation is utilized.
- b. Specify testing method verify appropriate required insulation depth.

24. Foundation and Under-Slab Insulation:

- a. In addition to code-required perimeter foundation insulation, UCB prefers under-slab insulation. Provide rigid, closed-cell, Extruded Polystyrene (XPS) tongue and groove board insulation.
- b. Provide foundation insulation with filter fabric on outer face or install drainage mat.

25. Rough Carpentry, Blocking, and Sheathing:

- a. Comply with applicable standards published by the American Wood Protection Association (AWPA) and the American Lumber Standard Committee (ALSC).
- b. Submit chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material.
- c. Provide documentation from the manufacturer identifying the VOC and chemical component limits for the materials provided.
- d. Fire Retardant Treated Wood:
  - 1) Include certification by treating plant that treatment material complies with specified standards, and governing authorities.
  - 2) Verify that fire retardant treatment will not reduce structural performance at elevated temperatures.

26. Exterior Painting:

- a. Provide paints and coatings which are weather resistant.
  - 1) Manufacturer and color to be approved by UCB.
- b. Refer to **Campus Standard B3020** for additional information pertaining to painting.

## **B2011 – Exterior Wall Fenestration**

### **Introduction**

This section includes requirements when designing exterior window openings, glazed storefront, and glazed curtain wall to be incorporated into the exterior envelopes for campus buildings.

### **UCB Requirements**

1. General Fenestration:

- a. Comply with applicable standards published by the American Architectural Manufacturers Association (AAMA) and National Fenestration Rating Council (NFRC), except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.

- b. The design team is expected to investigate double-glazing verses triple-glazing for which provides better life-cycle costs in support of the UCB Energy Master Plan goals.
  - c. Coordinate fenestration system design with exterior thermal and air/moisture control performance criteria identified in **Campus Standards A0020 and B2010**.
  - d. Coordinate 'window-to-wall' ratio with selected envelope assemblies to optimize U-values.
    - 1) Comply with High Performance Enclosures by John Straube. Refer to publication for best practices when determining U-value based on WWR and climate.
  - e. Provide aluminum frames that have integrally concealed thermal barrier located between extrusions which eliminates direct metal-to-metal contact between exterior and interior.
  - f. U-value:
    - 1) Provide maximum total .27 BTU/h-ft<sup>2</sup>-F for all fenestration systems. Confirm the design of the entire fenestration system meets the required U-value during design, taking into consideration mullion patterns which increase thermal breaks through the framing members.
    - 2) Show calculations of percentage of glass to percentage of framing members for all window configurations. The performance of the storefront/curtain wall U-value is dependent on the percent of glass divided by total area.
  - g. Provide minimum Condensation Resistance Factor of 50.
  - h. Coordinate door requirements, door hardware, locking and access controls for aluminum framed entrances with **Campus Standards B3010, B3011, and B3012**.
  - i. Window Washing:
    - 1) If fenestration system heights exceed 30', confirm permanent strategies for window washing with UCB. Fenestration systems that will require temporary scaffolding or movable lifts to maintain and clean is not acceptable.
  - j. Grade/First Floor Levels:
    - 1) Designing storefront or curtain wall systems at grade is discouraged because of the following:
      - i. Excessive cleaning due to water splashing off landscaping.
      - ii. Unnecessary replacement of glazing broken by skateboards.
  - k. Stairwells:
    - 1) Minimize glazing in stairwells, as UCB does not provide cooling in stairwells.
  - l. Colors:
    - 1) Provide colors for framing members consistent within campus context of the project.
2. Wind Load:
- a. Note that wind speeds vary across the campus. Refer to **Campus Standard B1011** for information pertaining to 'special wind regions' identified on campus.
    - 1) Special instances may require wind tunnel testing and analysis of fenestration system design.
    - 2) Design and engineer fenestration systems withstand applicable wind pressures.
3. Aluminum Framed Curtain Wall:
- a. Reference Products:

- 1) Kawneer 1600
    - 2) EFCO 5600
    - 3) Arcadia T500
  - b. External Sunshade Devices:
    - 1) Confirm shading strategies with UCB, as they will be expected to support the overall energy goals of the project.
    - 2) If external shade devices (louvers, blades, or outriggers) are specified, comply with the following:
      - i. Provide shade devices by the curtain wall manufacturer to ensure a completely integrated system.
      - ii. Provide profiles and components that are 'bird-resistant' to discourage birds from landing and/or nesting.
  - c. Design of curtain wall shall accommodate appropriate wind loads, building movement, and thermal expansion.
4. Aluminum Entrances and Storefronts:
  - a. Reference Products:
    - 1) Storefronts:
      - i. Kawneer: Trifab II 451T
      - ii. Tubelite T14000
      - iii. EFCO: 403X
    - 2) Aluminum Entrances:
      - i. Kawneer: 350 Tuffline
      - ii. Tubelite: Monumental
  - b. Framing members shall provide for flush glazing on all sides with through sight lines, with no projecting stops or face joints.
  - c. Provide wide stiles or confirm stile width is appropriate for specified door hardware.
  - d. Provide minimum 12" high bottom rail.
5. Aluminum Framed Windows:
  - a. Neoprene weather-stripping is required at all windows as indicated by AAMA Gold Label certification requirements.
  - b. Provide Class-CW windows as identified by AAMA.
  - c. Provide all windows of a similar type and model provided by a single manufacturer.
  - d. Operable windows are discouraged in all instances due to security and freezing issues, as they can be left open during building vacancy and cause HVAC balancing difficulties.
    - 1) Confirm with UCB if operable windows are acceptable in areas where optimal HVAC performance is required.
    - 2) Clearly identify locations of operable windows and confirm with UCB if operable windows are acceptable on a per project basis. At a minimum, locations must comply with the following:
      - i. Operable windows are not acceptable in areas of high-humidity, laboratory facilities, and other facilities where optimal HVAC performance is required.



- ii. If expected, provide operable windows that can only be opened with a special tool.
  - e. When specifying mode of operation, comply with the following:
    - 1) Awning units are preferred.
    - 2) Casement units are discouraged due to issues with conflicts with high winds.
    - 3) Hopper units are discouraged as they can allow infiltration of rain and snow if left open.
    - 4) If designing for UCB Housing and Dining Services (HDS), sliding units may be used as approved by UCB HDS.
    - 5) Provide screens at all operable windows.
    - 6) All operable windows to meet ADA requirements (i.e. reach height)
  - f. Provide operable window panels for allowing service (power cords, etc.) entry through opening. Panel does not require a screen but require specific tool for operation. Confirm required locations with UCB.
- 6. General Glazing:
  - a. Exterior Glazing:
    - 1) Confirm historical character of the building and adjacent buildings when selecting color of exterior glazing. Preferred color campus-wide is warm gray, however, glazing must be color-compatible within the context of the building.
    - 2) Consider directional orientation of fenestration systems when determining glass color, coatings, visible transmittance, and SHGC.
    - 3) The design team should review whether FRP frames versus gas-filled IGUs present a better value to the energy efficiency of the structure and discuss with UCB Campus Architect.
    - 4) Provide Low-E coating (PPG Solarban 60 or approved equal) on outer lite #2 for all windows to meet Solar Heat Gain Coefficient (SHGC) and match existing campus windows.
      - i. Low-E coatings typically aren't required for north facing glass but do help lower the U-value of the system.
      - ii. Provide visible transmittance of at least 40% with Low-E coating.
    - 5) Solar Heat Gain Coefficient (SHGC):
      - i. Do not exceed .32 for all east, west and south facing glazing.
  - b. Interior Glazing:
    - 1) Provide 1/4" glass at interior locations and at vestibules unless additional depth is required or recommended by manufacturer for large glazed applications.
- 7. Glass Types:
  - a. Mirror Glass:
    - 1) Use Clear Float Glass type for mirror glass, provide silver coating, copper protective coating and 2 mil thick paint coating.
    - 2) Mirrored glazing is not acceptable on the Main Campus.
  - b. Safety Glass:
    - 1) Provide the applicable safety glazing for the appropriate intended use.

- 2) For renovation work, use wired glass to match aesthetics of existing conditions.
- c. Tinted Glass:
  - 1) Ultraviolet filtering glass is preferred.
  - 2) Electro or chromodynamic glazing is only approved on a case-by-case basis.

## B2020 – Roof Coverings

### Introduction

This section includes requirements when design and specifying tile roof systems, membrane roofing systems, flashing and sheet metal, gutters and downspouts at the University of Colorado-Boulder (UCB).

### UCB Requirements

1. General Roofing Requirements:
  - a. Coordinate roofing system design with exterior thermal and air/moisture control performance criteria identified in **Campus Standards A0020 and B2010**.
  - b. Required Submittals/Review:
    - 1) Obtain UCB approval of roof system selection, manufacturer, submittals, roofing installer, and proposed roofing installation procedures.
    - 2) When project includes re-roofing alterations to an existing building, confirm with UCB as to which portions of IEBC are appropriate for the specific project.
    - 3) Obtain approval from UCB to alter configuration of any exposed material from specified configuration.
  - c. Roof Curbs:
    - 1) When required, provide roof curbs minimum of 18" above face of finished roof.
    - 2) Provide cap flashing over top of roof curb and coordinate roof curb heights with insulation thicknesses.
    - 3) Coordinate roof curb selection with rooftop mechanical equipment design.
  - d. Material Specification:
    - 1) Provide roofing and waterproofing assemblies from a single manufacturer or as recommended by roof membrane/roof tile manufacturer to ensure compatibility of all system components.
  - e. Fall Protection:
    - 1) Comply with OSHA Section 1926 and ANSI/ASSE Z359.1.
    - 2) Confirm required fall protection requirements with selected roof assembly. Coordinate fall protection requirements with UCB.
    - 3) Provide engineered fall protection system for maintenance of sloped roofs, coordinate with structural design or existing structure.
  - f. Research spaces or research equipment on roofs
    - 1) For new construction, identify areas on the roof where research equipment may be located. Confirm the space meets future loading requirements, electrical connections, and fall protection requirements.

**2. Wind Speed:**

- a. Note that wind speeds vary across the campus. Refer to **Campus Standard B1011** for information pertaining to 'special wind regions' identified on campus.
- b. Required Submittals/Review:
  - 1) Confirm wind uplift requirements with UCB for new construction, renovations and roof replacement.
  - 2) When designing for roof tile assemblies, provide engineer's letter stating that tile fastening method meets current building code and wind uplift requirements.
  - 3) Provide letter from the specified roofing system manufacturer describing the roofing system components, attachment method of each component, and the approved FM Global RoofNav number for the described roofing system.
    - i UCB may provide roofing design and specifications to the campus insurance carrier for review.
  - 4) When designing for flat roof assemblies, provide 90 mph wind speed warranty.

**3. General Clay Roofing Tile Requirements:**

- a. Comply with applicable standards published by the Tile Roofing Institute (TRI) and the National Roofing Contractors Association (NRCA).
- b. Required Submittal/Review:
  - 1) Engage roofing consultant/engineer to verify attachment of snow guards, substrate and gutters.
  - 2) Consult with UCB Campus Architect on colors and color blends during design prior to specifying tile.
    - i Prior to the contractor procurement of roof tile, verify color and color blend selection with UCB Campus Architect.
- c. Design Criteria:
  - 1) For sloped roofs, provide 5:12 pitch unless otherwise approved by UCB.
  - 2) To maintain safety of areas around buildings during shedding of snow, avoid designing sloped roofs that would shed snow on entrances, sidewalks and other public areas.
- d. Materials Specification:
  - 1) Provide One-Piece Barrel Spanish Clay Tile manufactured by Ludowici-Celadon unless otherwise approved by UCB.
    - i Selected style is expected to match existing construction and complement the adjacent campus context.
    - ii Any proposed substitution must be tested for strength, vitrification, color fastness and solar reflectance index (SRI) comparable with Ludowici-Celadon for consideration.
  - 2) Provide smooth, unglazed units, kiln fired to vitrification, and free of surface imperfections.
  - 3) Provide fastening holes pre-punched at factory before firing.
  - 4) Provide mortar to match the tile color.
    - i Synthetic mortar must be approved by UCB.
  - 5) New Construction:



- i Provide a color blend based on existing nearby roofs.
    - ii Provide matching ridge, eave, rake, hip, hip starter, top fixture, eave closure, and other fittings.
  - 6) Renovations or Major Additions:
    - i Match existing size, shape, finish, coursing and color blend of existing conditions.
    - ii Match the actual color of the tile, not the name as actual manufactured colors may change over time but manufacturer's color names have remained the same.
    - iii Remove existing tiles and re-blend with new as required to achieve a uniform appearance.
  - 7) Roof Penetrations:
    - i Provide self-sealing flashing jack with galvanized steel base interlaced into underlayment.
    - ii Provide EPDM rubber collar permanently attached.
    - iii On top of tile, provide lead jack with flanges interlaced into clay tiles. Extend sides of the jack flange over the ridge of adjacent tile.
- e. Installation:
  - 1) Install roof tile using "tight" method, maintaining uniform exposure and coursing throughout roof.
  - 2) Fasten all clay tile pieces, including pan and cover tile. No exceptions.
  - 3) Extend tiles 2" over eave fascia.
  - 4) Install minimum two layers of ice and water shield to extend 24-inches from interior wall. Soffit depth and wall thickness will dictate the amount of ice and water shield required.
  - 5) Installer Qualifications:
    - i Submit a minimum of two similar jobs successfully completed within the last four years with Owner and Architect references.
- f. Mock-ups:
  - 1) Refer to **Campus Standard A0020** for general mock-up information.
  - 2) Prior to construction, install 16' x 16' mock-up in-place on roof structure, showing full range of color, color distribution and trim pieces. Obtain UCB approval before proceeding with remainder of roof installation and revise mock-up until accepted. All or part of mock-up which is acceptable may be retained as part of permanent installation.
- g. Warranty:
  - 1) Manufacturer's warranty: (75) years from date of Substantial Completion.
    - i The manufacturer will agree to repair or replace tile that fails in materials within specified warranty period. Material failures include manufacturing defects that result in leaks.
  - 2) Roofing Installer's warranty: (2) years from date of Substantial Completion.
    - i The installer will agree to repair or replace components of clay tile roofing that fail in materials or workmanship.

4. One-Piece Barrel Spanish Clay Tile:
  - a. Material Specification:
    - 1) Field Tile: 18-3/8" length tile.
    - 2) Rake End Band: 18-3/8" length tile with two holes.
    - 3) Hip and Ridge: 18-3/8" length tile with exposed hole for an exposed fastener and sealant to prevent wind uplift.
    - 4) Provide top fixture and eave closures for all open tiles and head walls and eaves.
5. Two-Piece Straight Barrel Mission Clay Tile:
  - a. Material Specification:
    - 1) Field Tile: 16" length.
    - 2) Eave Starter: 14-1/4" length with exposed hole for an exposed fastener and sealant to prevent wind uplift.
    - 3) Hip, Ridge, Rake, and 2nd Eave Course: 18" length with exposed hole for an exposed fastener and sealant to prevent wind uplift.
    - 4) Provide top fixture and eave closures for all open tiles and head walls and eaves.
6. Other tile or shingle roofing:
  - a. Other tile roofing may be applicable outside the Main Campus. Design teams should coordinate with the CU project manager and planner for requirements.
  - b. All asphalt shingles shall be hail resistant and carry a UL 2218 Class 4 rating.
7. Snow Guards:
  - a. Design Criteria:
    - 1) Provide fully engineered system for snow guard design, location and attachment.
    - 2) Confirm with UCB if Facility Operations can provide snow guards.
    - 3) Match snow guard design with existing campus installations and confirm with UCB.
8. General Single-Ply or Built-up Bituminous Roofing Requirements:
  - a. Comply with applicable standards published by the National Roofing Contractors Association (NRCA) and Single Ply Roofing Industry (SPRI).
  - b. Design Criteria:
    - 1) Hail Rating: All low-slope roofing assemblies are required to meet FM Global requirements for Very Severe Hail (VSH) rating.
    - 2) Due to high winds blowing rock ballast off roofs and creating ground-level hazards, rock ballast is not acceptable for new roof construction. This includes decorative rock ballast over adhered single-ply membrane.
    - 3) Mechanically fastened and ballasted roofing membranes are not allowed unless otherwise approved by UCB.
    - 4) New Construction:
      - i. Slope the roof structure to achieve drainage and use tapered insulation for crickets only.
    - 5) Existing Roof Renovation or Repair:

- i On existing roofs with no structural slope, use tapered insulation as required to achieve positive drainage.
- c. Roof Insulation:
  - 1) Minimum R-38 continuous insulation is required. For low-slope roofs, the minimum R-38 should occur at the roof drains. An area-weighted or 'average' R-value of R-38 is not acceptable.
  - 2) When renovating an existing roof, identify where existing conditions will not allow for roof insulation depth to meet code requirements. Submit a variance request to identify areas where impractical or infeasible to meet code.
- d. Roof Access:
  - 1) Provide walking pads with textured surface compatible with selected roof membrane.
  - 2) Because membrane roofs can be slippery due to rain, snow, and ice, provide continuous walking path from roof access location to areas that require frequent maintenance and access to fall protection.
  - 3) To maintain safe working areas and protect the roof membrane near frequently maintained equipment, provide additional walking pads in areas where maintenance personnel would need working space to perform maintenance duties.
- e. Roof Penetrations:
  - 1) Provide roofing system manufacturer's one-piece prefabricated boots. Two-piece field wraps are only acceptable where boots cannot be installed due to field conditions.
  - 2) All vertical roof penetrations shall have a minimum of 12-inches of horizontal separation to allow for appropriate flashing.
  - 3) Connections/fittings to roof penetrations should be a minimum of 18-inches above deck to allow for up to 6-inches of insulation and a minimum of 12-inches clear above roofing material to allow for appropriate flashing.
  - 4) Square tube steel, such as Unistrut, shall not be used for roof penetrations as square tube steel is difficult to seal and typically ends up with small openings on the corner when a clamp is applied. Only round tube steel is permissible.
- f. Warranty:
  - 1) Two (2) year roofing installer's warranty from date of Substantial Completion. Provide executed copy of a standard 2-year "Roofing Guarantee", covering roofing membrane, composition flashing, roof insulation, vapor retarders (if any), and roofing accessories, signed and countersigned by installer (roofer) and contractor.
  - 2) Twenty (20) year manufacturer's warranty from date of Substantial Completion. Provide executed copy of roofing manufacturer's 20 Year Labor and Materials Guarantee, signed by an authorized representative of the roofing system manufacturer. Guarantee shall cover roofing membrane, base flashings, roofing membrane accessories, roof insulation, fasteners, cover board, and other single-source components of the roofing system. Guarantee shall have unlimited dollar coverage for the full period of the guarantee and shall not be subject to a deductible.

**9. Standing Seam Metal Roof**

- a. Only to be used in areas where PV will be mounted on sloped roofs.

**10. Single-Ply Membrane Roofing:**

- a. To maintain campus consistency and address maintenance concerns, UCB only allows three types of single-ply roofing membranes as listed below:
  - 1) Firestone Building Products Company, Carlisle Syntec or Versico Roofing Systems for EPDM (90 mil) membranes.
  - 2) Firestone Building Products Company: UltraPLY, Carlisle-SynTec Inc.: Sure-Weld or Versico Roofing Systems: VersiWeld for TPO (80 mil) membranes.
  - 3) FiberTite Roofing System, Seaman Corporation, FiberTite-XT for KEE (60 mil) membranes.
- b. Roof Membrane:
  - 1) Solar Reflectance Index: Minimum of 78.
  - 2) Fully adhere the roof membrane to a cover board.
    - i Adhering the membrane directly to insulation is prohibited.
- c. Cover Board:
  - 1) Provide cover board over the thermal insulation.
  - 2) Adhere the cover board to the insulation to conceal fasteners and plates.
  - 3) Provide one of the following:
    - i Non-structural, glass mat-faced roof boards with a non-combustible, water-resistant and silicone-treated gypsum core panel.
    - ii High density Polyisocyanurate insulation cover board.
- d. Roof Insulation:
  - 1) Provide Polyisocyanurate board insulation with felt or glass-fiber mat facer on both major surfaces.
  - 2) Mechanically fasten the insulation to metal roof decks and fully adhere to concrete decks.

**11. Built-up Bituminous Roofing:**

- a. Bituminous roofing system is not acceptable unless in instances of renovation of an existing bituminous roof.
  - 1) Provide insulation cover board.
  - 2) Provide aggregate surfacing set in asphalt flood coat to match adjacent existing roof.
  - 3) Utilize a fume recovery unit on all asphalt kettles.
- b. Preferred Manufacturers:
  - 1) GAF Building Materials Corp., Johns Manville or Firestone Building Products Company.

**12. High Humidity Area Vapor Barriers:**

- a. Provide a vapor barrier for roofs over pools, shower rooms, kitchens, and other high humidity areas.
  - 1) Provide vapor barrier of type recommended by roofing manufacturer.



- b. Install vapor barrier over compatible substrate board attached to roof deck.

13. Flashing and Sheet Metal:

- a. Conform to requirements and recommendations of the following as applicable including joints, seams, details and accommodation of thermal movement:
  - 1) Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA): “Architectural Sheet Metal Manual”
  - 2) National Roofing Contractors of America (NRCA): “Roofing and Waterproofing Manual”
  - 3) Copper Development Association (CDA) when designing for copper metal flashing applications.
- b. Performance Criteria:
  - 1) Design sheet metal and flashing installations to withstand 100 mph wind uplift.
  - 2) Design installations to be free from water leakage under all weather conditions.
- c. Mock-ups:
  - 1) Refer to **Campus Standard A0020** for general mock-up information.
  - 2) Incorporate fit and profile of all major flashing details into the mock-up, including, but not limited to parapet cap flashings, counter flashing, eave/gutter, sidewall flashing, headwall flashing and exposed fascia and trim.
- d. Material Selection:
  - 1) All exposed flashing and sheet metal items on the main campus are to be fabricated from copper except items directly related to pre-finished metal panels.
  - 2) Items at the East Campus are at the designer’s discretion subject to approval by the UCB Campus Architect.
- e. Material Properties:
  - 1) Zinc-Coated Steel Sheet: G90, 20 gauge.
  - 2) Copper Sheet: Refer to CDA, Inc. recommendations.
  - 3) Stainless Steel Sheet: AISI Type 302/304 stainless steel sheet or strip, 24 gage.
  - 4) Pre-finished Flashing: Fluoropolymer coating applied to 24 gage, G90 galvanized steel, containing 70% Kynar 500 resins, factory applied baked-on finish. Color as selected from standard color charts.
- f. Warranty:
  - 1) Roofing Installer’s warranty: (2) years from date of Substantial Completion. Include replacement at contractor’s expense any defects which occur during the warranty period which, in the opinion of the Architect are due to defective materials, workmanship, or for failure to allow for expansion and/or contraction.
  - 2) Pre-Finished Sheet Metal Finish Warranty: (20) years from date of Substantial Completion in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes. Include certificates of production showing quality control records for the specific material installed. Warranty must address the following criteria:
    - i Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - ii Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

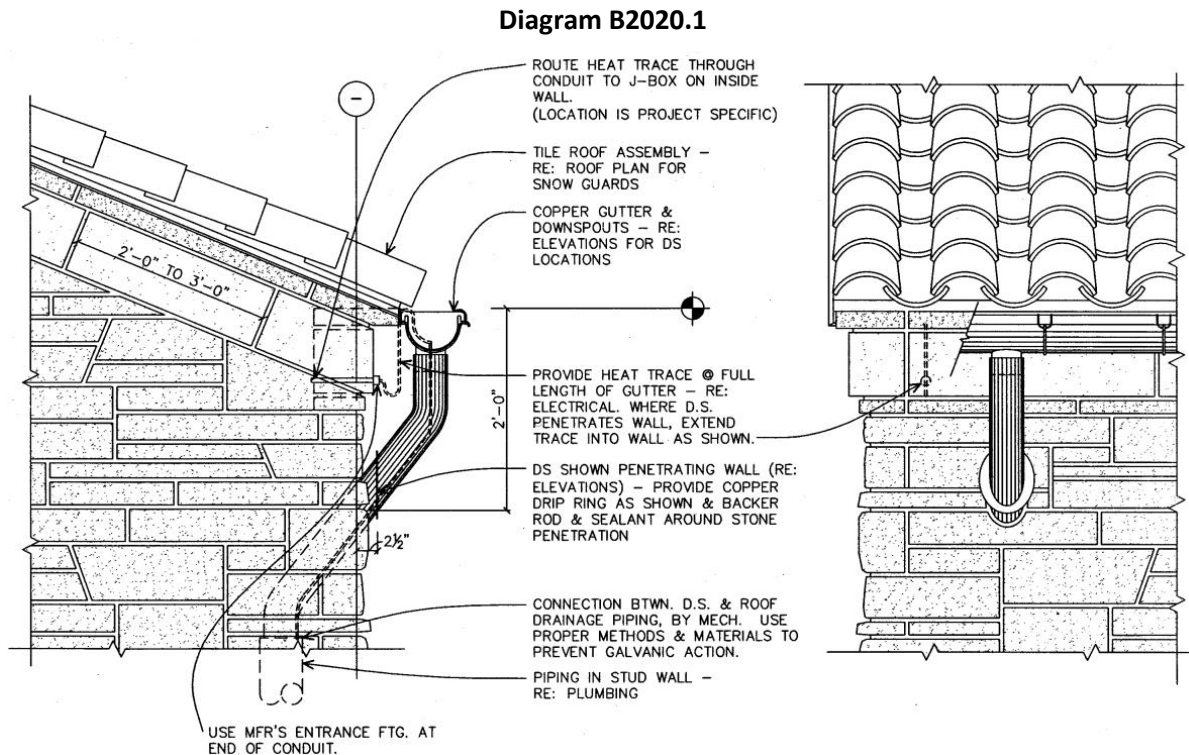
- iii Cracking, checking, peeling, or failure of paint to adhere to bare metal.

**14. Tile Roof Flashing and Sheet Metal Materials:**

- a. Provide copper metal for all flashing and counterflashing associated with tile roof system. Intent is for flashings to match existing campus buildings.
- b. Provide 16-ounce cold rolled copper at all flashings between tile roofs and vertical surfaces. Run flashing a minimum 2" higher than the tile and covering the first roll of tile. Flashings to be lapped 6" and to be secured with 4" wide floating 22-gauge stainless steel cleats at 36" on center or continuous 22-gauge stainless steel cleat. Stainless steel is used to prevent staining and degradation of supports over time.
- c. Provide box flashings along rakes.
- d. Counterflash all wall flashings.
- e. Use edge strip along all exposed sheathing edges.

**15. Gutters and Downspouts:**

- a. Refer to **Diagram B2020.1** for preferred design of gutters, downspouts and heat trace.



**b. Gutters:**

- 1) Provide gutters at the draining edge of all tile roofs, unless otherwise approved by UCB Campus Architect.

- 2) All gutters shall be 24-gauge galvanized iron or equivalent copper (where appropriate), half round, 4" deep, 5" wide, both edges rolled over 5/8" copper coated steel rod and set at a pitch of 1/4" per 10' to drain.
  - i Because the copper gutter type shown in **Diagram B2020.1** is difficult to find for sizes over 6", verify roof drainage requirements and strategies to meet intent of **Diagram 2020.1**.
- 3) Provide Berger Brothers, shank-type, adjustable hangers at 24" o.c. spacing.
- 4) Solder all joints, unless slip joints are needed to account for expansion.
- 5) Provide heat trace for full length of gutter and extend into downspout as indicated in **Diagram B2020.1**.
  - i Locate heat trace outlet inside the building behind gutter, within 6-12" horizontally of the downspout. Coordinate location with electrical design drawings.
- c. Downspouts:
  - 1) Provide internal cast-iron downspouts. External galvanized steel or copper downspout should only be visible for approximately 2' to connect gutter to internal downspout.
    - i Full-length exposed downspouts are not acceptable unless otherwise approved by UCB.
  - 2) Run external downspout down approximately 2' below gutter and make 90-degree turn. Loosely fit into exterior portion of internal downspout approximately 6" from face of exterior veneer.
  - 3) Provide internal cast-iron downspout with 90-degree turn at top. Extend 90-degree turn approximately 6" outside of exterior veneer.
    - i Provide continuous neoprene wrap all sides of external downspout to prevent galvanic action with internal downspout.
    - ii Provide drip flange at loose-fitting to minimize outside water infiltration at wall penetration.
  - 4) Coordinate internal downspout locations with plumbing design drawings.
  - 5) Provide cleanouts at each story of multi-story building.
- d. Connect internal downspouts into subsurface drainage system.

## B2021 – Roof Openings

### Introduction

This section includes requirements when designing metal framed skylight systems with glass or translucent insulating panels at the University of Colorado-Boulder (UCB).

Use of skylights for UCB facilities is discouraged. Obtain approval from UCB Campus Architect prior to incorporating skylights into building design.

### UCB Requirements

**1. General Skylight Requirements:**

- a. Comply with applicable standards published by the American Architectural Manufacturers Association (AAMA), North American Fenestration Standard (NAFS), and National Fenestration Rating Council (NFRC), except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.
- b. Reference Products:
  - 1) Provide manufacturers from list of certified manufacturers provided by NFRC.
- c. Coordinate roof opening design with exterior thermal and air/moisture control performance criteria identified in **Campus Standards A0020, B2010 and B2012**.
- d. Confirm selection of translucent panel skylights, metal framed skylights or tubular daylighting units with UCB Campus Architect.
- e. During the design phase, consider how UCB will be expected to access, clean, and maintain the skylight units. Incorporate permanent strategies into the design and confirm with UCB.
- f. Provide aluminum alloy for framed skylight extrusion materials.

**2. Tubular Daylighting Units:**

- a. In many instances, tubular daylighting units are preferred over skylights.
- b. Confirm required base flashings are compatible with selected roof assembly. Refer to **Campus Standard B2012** for additional information in regard to roof penetrations.
- c. If utilizing tubular daylighting units, coordinate shaft locations with building layout and confirm any fire-ratings required for through-building shafts.

**3. Roof Hatches:**

- a. Confirm roof hatch dimensions with UCB based on UCB Facilities and Maintenance requirements.
- b. Confirm presence of required fall protection from roof hatch to all serviceable rooftop equipment.

## **B3010 – Doors**

**Introduction**

This section includes requirements when designing and specifying both exterior and interior doors for the University of Colorado-Boulder (UCB). CU Boulder has had issues with the timeliness of door submittals, often after installation. Project teams should take steps to ensure UCB Access Services receives the submittals prior to installation.

Refer to **Campus Standard B2011** for information pertaining to aluminum framed entrances.

**UCB Requirements****1. General Doors and Frames:**

- a. Coordinate door and frame specification with exterior thermal and air/moisture control performance criteria identified in **Campus Standards A0020 and B2010**.



- b. Coordinate door hardware, locking and access controls for the preparation of hollow metal frames with **Campus Standards B3011 and B3012**.
  - c. Exterior Doors:
    - 1) Provide maximum .24 U-value.
    - 2) Neoprene weather-stripping is required at all exterior door openings.
    - 3) Wood doors are not acceptable for exterior applications unless working in historical renovation areas.
2. Hollow Metal Doors and Frames:
- a. Comply with applicable standards published by the National Association of Architectural Metal Manufacturers/Hollow Metal Manufacturers Association (NAAMM/HMMA) and the Steel Door Institute (SDI).
    - 1) Provide SDI Level 3 Classification unless approved otherwise by UCB.
  - b. Reference Products:
    - 1) Ceco
    - 2) Curries
    - 3) Republic
    - 4) Steelcraft
  - c. Preferred Supplier:
    - 1) Colorado Doorways, Inc.
  - d. Finish:
    - 1) Provide hot-dipped zinc-alloy coating for exterior doors and frames.
    - 2) Provide zinc coating for interior doors and frames.
  - e. Door Hardware Installation:
    - 1) No self-tapping screws to be used on aluminum frames or doors to mount any door hardware or related products.
  - f. Frames:
    - 1) Provide minimum 14-gauge exterior frames, thermally broken.
    - 2) Provide minimum 16-gauge interior frames, or 14-gage if opening is over 36" wide.
    - 3) Provide fully welded reinforced frames with mitered corners. "Knock-down" type frames are not acceptable unless approved otherwise by UCB.
    - 4) Fully grout all metal door frames in masonry walls.
  - g. Doors:
    - 1) Provide seamless construction, with no visible seams along face of vertical edges.
    - 2) Provide minimum 16-gauge face-sheet for exterior doors.
    - 3) Provide minimum 18-gauge face-sheet for interior doors.
3. Interior Flush Wood Doors:
- a. Reference Standard: Comply with AWI Quality Standard Section 1300, Custom Grade, and NWWDA I.S. 1 "Industry Standard for Wood Flush Doors". If there are conflicts between AWI and NWWDA, AWI requirements will govern.
  - b. Reference Product:
    - 1) Marshfield-Algoma
  - c. Preferred Supplier:

- 1) Colorado Doorways, Inc.
- d. Door Construction:
  - 1) Core: AWI “PC-5” type, solid particleboard core with solid stiles.
    - i. Provide mineral core doors with fire-rating as required.
  - 2) Door Faces: Provide plain sliced Red Oak or Birch veneers, both sides.
    - i. Typically, provide AWI Premium Grade veneers.
    - ii. Not all doors in a project may require premium grade veneers. Some doors may only need custom or economy grade veneers; confirm locations with UCB.
    - iii. Match existing, adjacent veneers in remodel work.
  - 3) Edge Stiles: Over time, door edges often need to be planned to allow efficient opening and closing or doors need to be re-hinged. Because of this issue, provide factory applied hardwood edges, matching door face veneer with the following properties:
    - i. Specify hardwood edge depth providing the ability to plane the door on each side at least 1/2”.
    - ii. Provide solid backing behind hardwood edge to allow for re-hinging and plugging.
- e. Glazing:
  - 1) To provide aesthetic consistency within existing facilities, wired glass may be required for fire-rated doors. Confirm glazing specification with UCB. Refer to **Campus Standard B2011** for additional information pertaining to glazing.

## **B3011 – Door Hardware**

### **Introduction**

This section includes requirements when specifying door hardware to be incorporated into the exterior and interior door hardware packages. Coordinate the requirements listed in this section with those listed in **Campus Standards B3010 and B3012**.

The goal is for the specified hardware and systems to be fully integrated with into the existing campus. To achieve full integration and maintain consistency across all campus facilities, no substitutions are acceptable for specific hardware or preferred products listed.

**For each project, work with UCB Access Services to develop the hardware specification. UCB Access Services must approve both door and door hardware submittal prior to purchase and installation. Existing doorknob hardware should NOT be matched. All efforts should be made to replace doorknobs outside of the project boundary. Project team should work with CU Planning and Fire Marshal to determine extents.**

All door hardware will comply with all ANSI, NFPA, and building code regulations, and UL requirements as applicable for the project installation. All door hardware to comply with federal and campus

accessibility requirements. Design consultant is required to review **Campus Standard A0040** for additional requirements as they pertain to door hardware and operations.

### **UCB Requirements**

#### **1. UCB Review/Submittals:**

- a. Conduct a Pre-Design meeting with UCB Accessibility Officer prior to commencing Schematic Design phase to create strategies for designing all building entries to be accessible.
- b. Meet with UCB Access Services prior to beginning the construction document phase to develop door hardware sets and hardware operations.
- c. Meet with UCB Access Services during the design phase to review storefront locations and door hardware specifications.
- d. For renovation projects, work with UCB to determine scope of door hardware to be replaced:
  - 1) Provide new hardware which provides consistency within the facility in terms of operations, security, and aesthetics.
  - 2) Consultants, in many instances, it is the intent that door hardware to be updated within the scope of work, however, confirm with UCB which doors are required to receive updated hardware.
  - 3) Some doors outside of the main area of renovation may be required to receive new hardware as part of project. Confirm with UCB Project Manager.
- e. Prepare door hardware schedule including “hardware sets” indicating complete designations of every item.
  - 1) Hardware sets to include specific hardware operations for every door opening.
  - 2) Include room number and door number with submitted door hardware package with each submittal, revised submittal
  - 3) Include all electro-mechanical door hardware equipment in door hardware sets.
  - 4) List the make and model of each product used for door hardware

#### **2. Active Arming Campus Safety Requirements:**

- a. Work with UCB Access Services to identify direction for active arming systems.

#### **3. Qualifications:**

- a. Obtain hardware from a recognized builder’s hardware supplier, with warehousing facilities, who has been furnishing hardware in the Denver-Metro area for a minimum of 3 years.
- b. Supplier must employ an experienced AHC certified hardware consultant, available for consultation during the project. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of all hardware products.

#### **4. Manufacturer’s Warranties:**

- a. 2-year warranty on failure on parts of all hardware except door closers and locksets.
  - 1) 10-year warranty for mechanical failure on door closers.
  - 2) 5-year blanket coverage on locksets.
- b. 7-year comprehensive mechanical warranty on lockset, lifetime warranty against lever sag and lever spring breakage.

5. General Door Hardware Requirements:

a. Finishes:

- 1) New Construction and Major Rekeying: US26D Satin Chrome.
- 2) Renovations: Match finish of existing hardware in adjacent areas.
- 3) Alternate finishes as approved by UCB Campus Architect.

6. Hinges:

a. Reference Products:

| MANUF.  | PRODUCT NUMBER |         |        |
|---------|----------------|---------|--------|
| STANLEY | FBB179         | FBB199  | FBB168 |
| HAGER   | BB1279         | BB1199  | BB1168 |
| IVES    | 5BB1           | 5BB1-HW |        |

- b. Provide five-knuckle, button tip, full mortise template type with non-rising loose pins and ball bearings.
- c. Provide heavy-duty hinges at all exterior and high-traffic doors.
- d. Pivot and continuous hinges are not acceptable.
- e. Exterior Doors:
  - 1) Four-ball bearing hinges with non-removal pin construction or non-rising loose pin with security set screw.
    - i. Non-removable pin and security screw on all reverse bevel hinges.
  - 2) Locations:
    - i. Provide minimum (4) hinges per door leaf for doors 36" or less in width and 84" or less in height.
    - ii. Provide (1) additional hinge for each 24" of additional height or 6" of additional width or fraction thereof.
  - 3) Dimensions: 5"x5"
  - 4) Materials/Finishes: .180- or .190-gauge stainless steel with stainless steel fasteners.
- f. Interior Doors:
  - 1) Provide ball bearing type hinges.
  - 2) Locations:
    - i. Minimum (3) hinges per door leaf for doors 36" or less in width and 84" or less in height.
    - ii. Provide (1) additional hinge for each 24" of additional height or 6" of additional width or fraction thereof.
  - 3) Dimensions:
    - i. 4 1/2"x4 1/2" hinges for doors up to 36" width.
    - ii. 5"x5" hinges for doors over 36" width.
  - 4) Materials/Finishes: .134 or .145 wrought steel
    - i. Stainless steel with stainless steel fasteners in areas that experience very high humidity.

**7. General Keying and Cylinders:**

- a. The campus key system standard is High Security Medeco 'm3' technology.
- b. Supply all keyed function locks capable of accepting Medeco 31-series Large Format Interchangeable Cores (LFIC).
- c. All Schlage products take the Z34 cam.
- d. Temporary Installation During Construction:
  - 1) The contractor is responsible to supply all locks with temporary cylinders (Yale/Medeco 31 series type LFIC) during construction to secure the building until replaced with final cylinder.
  - 2) The contractor will provide a copy of the temporary control key to UCB Access Services.
- e. Final Installation:
  - 1) UCB Access Services provides final cores and cylinders and performs final installation.
  - 2) Permanent cores are High Security 'm3' cores, Medeco 31-series, 6-pin and 7-pin.

**8. Mortise Locks:**

- a. Provide Schlage L9000 Series Heavy Duty Mortise Type, non-handed case.
  - 1) Mortise Cylinder Housing: Medeco 31-0175 with Z34 cam 6-pin
  - 2) Medeco 31T0100 6-pin LFIC provided by UCB Access Services
- b. Lock Throw: 3/4" minimum throw of latch and 1" minimum throw of deadbolt.
- c. Provide cast lever and cast escutcheon Schlage #03L.

**9. Cylindrical Locks:**

- a. Provide Yale 5400LN AU 1220 prep LESS CYLINDER, cylindrical lever locksets.
  - 1) Cylinders: Medeco 31T0100A 7-pin LFIC provided by UCB Access Services
  - 2) Order with 1220 prep for 7-pin operation
  - 3) Cylinders – Mortise – Medeco 31T0100

**10. Exit Devices:**

- a. Provide Von Duprin #99 Series (or #33 Series, if door consists of narrow aluminum stiles).
  - 1) Rim Cylinder Housing: Medeco 31-0153H x Y02 7-pin
    - i. Because of the longer trim, contractor will provide cylinder solid blocking spacer rings as required. Provide solid blocking spacer rings that match the finish of the door hardware.
  - 2) Cylinder: Medeco 31 Series 7-pin LFIC
- b. Vertical Rods:
  - 1) Von Duprin 9927 (LBR less bottom rod) for wood doors.
  - 2) Von Duprin 9947 (LBR less bottom rod) for metal doors requiring a fire rating at a double door situation with no mullion.
- c. Vertical Cables:
  - 1) If vertical cable panic hardware is specific for aluminum framed doors, door must be prepped in the factory.



- d. Except on fire-rated doors, wherever closers are provided on doors equipped with exit devices, equip the units with Allen key dogging device to hold the push bar down and the latch bolt in the open position.
- e. Provide through-bolt mounting on all doors including center cases, end cases, rod guides and latches.
- f. Cast lever and cast escutcheon, Schlage Lock Co. #06L on VonDuprin 996 panic hardware.

11. Mullions:

- a. Provide Von Duprin 9954/4954 series with Z01 cam.
  - 1) Mortise Cylinder Housing: Medeco 31-0175 6-pin
    - i. Contractor will provide cylinder solid blocking spacer rings as required.
- b. Provide removable steel mullion with malleable-iron top and bottom retainers.
- c. Provide keyed removable feature, stabilizers, and mounting brackets.
- d.
- e. Mount top mullion fitting and bottom mullion plate pre-manufacturers specifications, using manufacturers recommended fasteners.
- f. Finish: Primed paint.

12. General Housing, Collars, Cams and Tailpieces:

- a. Provide Mortise and Rim Cylinder Housing of appropriate length to engage hardware chassis/lock body locking mechanism and not protrude excessively from escutcheons.
- b. Mortise and Rim Cylinder Collars (when needed):
  - 1) Install solid blocking rings
  - 2) Solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
- c. Provide cams and tailpieces to match and be compatible with specified lock/hardware manufacturer.
- d. Cylinder housing:
  - 1) Mortise 31-0175.
  - 2) Rim 31-0153Hx-YO2 tail piece

13. Door Closers:

- a. Provide LCN 4040 XP.
- b. Provide LCN 9500 series for flood doors and automatic accessible openings.
  - 1) Identify senior swing properties for accessible openings.
- c. In double door applications, provide LCN 9500 series on the right-hand reverse door and provide the LCN 4040 XP on the other door. All ADA buttons must be hardwired with a minimum 18/4. If no electrical access on door, buttons will be wired direct to operator. Provide Extra Duty Arm (EDA) on parallel arm applications.
- d. Provide "CUSH" arm where required.
- e. Mounting LCN 4040 Door Closers: Mount parallel arm with through bolt mounting.
- f. Provide delayed action closer where necessary only on interior doors as required for accessibility requirements.



- g. Adjust closers to comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather, wind conditions; and adjust for positive latching security doors.
- h. Finish: Match to door hardware (powder-coated if necessary).

14. Doorstops:

- a. Locate in position to permit maximum door swing but not to present a hazard or obstruction.
- b. Provide solid blocking in walls for wall mounted stops to prevent "punch through" by door action.
- c. Kick-Down Doorstops: Provide at all restroom doors, except in doors that are fire rated.
  - 1) Most restroom doors are often propped open overnight and UCB repairs many restroom doors damaged from "improvised" methods and materials used to prop these doors open.

15. Push/Pull Units and Kick Plates:

- a. Provide manufacturer's standard with exposed fasteners.
- b. Mounting: Through-bolted push/pull units for matched pairs, but not for single units.
- c. Trim Plates: .050" in thickness.
- d. Protection Plates (armor, kick, or mop): Minimum 2" less than door width on stop side and minimum 1/2" less than door width on pull side.
- e. Wheelchair Entries: Kick plates shall be a minimum 12" high and 3/8" from bottom of door.
- f. Exterior Door Pulls: Straight pull type required, offset pulls require approval by UCB.

16. Thresholds:

- a. Provide flat corrugated thresholds, with abrasive surfaces at all exterior openings.
- b. Finish: Natural aluminum.

17. Overhead Holders:

- a. Provide Glynn Johnson 900 or 100 Series
- b. Mounting: Through-bolted on all doors unless otherwise approved by UCB.
- c. Do not use devices with "hold-open" feature, electromagnetic or otherwise, for doors which are to be used for "airlock" vestibules (typically at exterior doors), or stairwells that serve as vestibules.

18. Automatic Flush Bolts and Coordinators:

- a. Automatic flush bolts or coordinators are not acceptable, unless approved by UCB Campus Architect or required by code.
  - 1) Never allowed on door bottoms.
  - 2) Never allowed on wood doors; application on metal doors may be considered.
- b. Use of National Guard No. 2525 smoke seal may eliminate the need for automatic flush bolts and door coordinators and is the preferred design solution.

19. Weatherstripping:

- a. Provide weatherstripping at the edges of:
    - 1) Exterior door leaf
    - 2) Computer room doors
  - b. Finish: Housing to be natural aluminum finish.
- 20. Door Sweeps:
  - a. Provide brush style door sweeps or as approved by UCB. Mount to the pull side of the door.
- 21. Door Trim Units:
  - a. Unless otherwise noted, use manufacturer's standard exposed fasteners for door trim units (kick plates, edge trim, viewers, knockers, mail drops, and similar units).
  - b. Use non-corrosive fasteners as recommended by manufacturer for application indicated.
- 22. Automatic Door Operators:
  - a. Preferred Products:
    - 1) LCN 9500 series.
    - 2) Wall Plate Actuator:
      - i. LCN 8310 Hardwired
      - ii. LCN 8310-818
      - iii. LCN 8310-855 Dual Vestibule buttons
  - b. Provide power keyed cutoff switch; confirm specification with UCB.
  - c. Design system to allow handicap access after-hours when building is secured. Provide devices which may be left turned on after-hours without causing damage or undue wear to the device or any other associated hardware. Use ES relay if integrated into electronic hardware.
  - d. Rod and Arm Assembly Shoes: Provide through bolt mounting on all doors.
  - e. Confirm Card Reader Integration with UCB Access Services.
  - f. Wireless is strictly not allowed
- 23. Coordination with Housing and Dining Services (HDS):
  - a. If designing for HDS, refer to **Campus Standard F2020** for additional information pertaining to HDS Integrated Security Standards.

## **B3012 – Electro-Mechanical Door Hardware**

### **Introduction**

This section includes requirements when specifying electro-mechanical door hardware to be incorporated into the exterior and interior door hardware packages. Coordinate the requirements listed in this section with those listed in **Campus Standards B3010 and B3011**.

The vendor is responsible for programming Initial panel set up, door devices, and doors following Access Service's programming abbreviations. Further programming in CCure will be performed by UCB Access Services.

### UCB Requirements

#### 1. General Requirements:

- a. Work with UCB Access Services for security consultation and to confirm engineering requirements.
- b. From UCB Access Services, obtain a complete list of Software House products currently used on campus to aid in production of design documents.
- c. Use the UCB Standard CCURE wiring diagrams to aid in the production of design documents.
- d. All national, state, and local applicable codes must be strictly followed along with manufactures specifications for installs. Coordinate electro-mechanical hardware with all other specified door hardware, existing and new, as applicable to the project.
- e. Provide finishes to match door hardware as indicated in **Campus Standard B3011**. Coordinate all the various electro-mechanical hardware with complete specified door hardware sets to ensure an acceptable uniform finish.
- f. Paint exposed security conduit per **Campus Standard B3020**.
- g. Include all electro-mechanical hardware in the contract document door hardware specifications.

#### 2. Active Arming Campus Safety Requirements:

- a. Work with UCB Access Services to identify direction for active arming systems.

#### 3. Construction:

- a. Notify UCB Access Services three weeks prior to planned installation of any devices that will require data communication.
- b. As part of the project close-out, the contractor and design team will submit:
  - 1) Complete as-built CAD drawings identifying each component, system operation, and wiring system. Refer to **Campus Standard A0023** for additional information.
  - 2) CCURE Port Charts will be provided to Access Services by the contractor. Factory authorized wiring diagram for all electro-mechanical hardware.
  - 3) Maintenance manuals identifying operating procedures and normal maintenance required for each type of hardware. Include a complete parts list.
- c. During the close-out portion of the project, the contractor will:
  - 1) Perform start-up of system, a full system check-out, and any required adjustments to confirm system meets UCB Access Services operating requirements.
  - 2) Demonstrate system operation to UCB Access Services and instruct personnel on proper operation and maintenance of each item.
  - 3) Coordinate final inspection with UCB Access Services. Project will not be completed until UCB Access Services has completed inspection and provided approval.



4. Qualifications:
  - a. Installers to provide manufacturer's authorization and certification for installation of hardware and equipment as required.
  - b. Refer to **Campus Standard A0020** for additional qualification requirements.
5. Warranties:
  - a. Provide a 2-year warranty on failure on parts of all electro-mechanical hardware.
6. Panel/Controllers:
  - a. Preferred Product: Software House CCure iStar Ultra or iStar Edge
    - 1) Verify model with UCB Access Services.
7. Card Readers:
  - a. Preferred Product: Software House 4000 series readers
    - 1) Verify exact model with UCB Access Services.
8. Key Switches:
  - a. Preferred Product: Securitron MKA key switch.
  - b. Confirm wiring of key switch and LED with UCB Access Services.
9. Electronic Access:
  - a. The campus standard system is the Software House CCURE 9000 (or current version, as identified by UCB Access Services). All access controls will be integrated into this system.
    - 1) Identify hardware integration in hardware specifications.
    - 2) Confirm proper specification and installation of access control and CCTV systems with UCB Access Services.
  - b. The campus access control system operates with the campus "Buff OneCard".
    - 1) Note: Only factory certified dealers are authorized to purchase and install this equipment.
10. Electric Strikes:
  - a. Discuss all electric strike applications with UCB Access Services during design.
  - b. Preferred products:
    - 1) HES
      - i. 18500 strike and option plate
      - ii. 9600 rim strike
      - iii. 4500 strike
11. Electro-Magnetic Locks:
  - a. Not allowed unless approved by variance request.
12. Electrified Lever Sets and Crash bars:
  - a. Preferred products:



- 1) Von Duprin QEL
- 2) Sargent 8271
- 3) Schlage L9092EU-RX
- 4) Schlage L9092EL-RX

13. Power Supply:

- a. Preferred products:
  - 1) Altronix Maxim 33 with PD4
- i. The top power supply must be set to 12 volts and wired to the PD4 to supply power to the panels.
- ii. The lower power supply will be set to 24 volts and wired to the two PD8's to supply power to field devices.
- iii. AC loss and battery fail outputs must be wired to the associated panels dedicated inputs.
  - 2) Life Safety Power FP015/250-2D82M8NL4E85
  - 3) Altonix AL600ULXB must be used for ISTAR Edge installations
- i. The 8<sup>th</sup> output will be used to power the Edge panel.
- b. 120 volts AC power will have a keyed cutoff switch to power down the power supply.

14. Electrical Power Transfer:

- a. Preferred products:
  - 1) Von Duprin EPT-10
  - 2) Securitron EPT

15. Electrified Hinges:

- a. Preferred product:
  - 1) Marray TEF 2x4

16. Emergency Exit Button:

- a. Preferred Products:
  - 1) Securitron EEB3N for mullion applications.
  - 2) Securitron EEB2 for 1 gang box applications.
  - 3) ESSEX piezoelectric switch PEBSS2-US or PEBSSN2-US
- b. Provide 30 second delay.
- c. Confirm wiring direction with UCB Access Services.

17. Door Contacts:

- a. All access-controlled doors must have a door position switch.
- b. All door contacts must be supervised with 1K/2K resistance.
- c. Door contacts must be in the door header between 3" and 10" from the opening edge.
- d. Double pull, double throw are acceptable when necessary.
- e. Preferred products
  - 1) GRI180-12WG-WH or equivalent ¾" recessed contact.
  - 2) GRI4402-a or equivalent armored surface mount contact.

18. Request to Exit Device:

- a. All access-controlled doors must have a request to exit device.
- b. All request to exit devices must be supervised with 1K/2K resistance.
- c. Preferred products:
  - 1) Von Duprin 330-RX.
  - 2) BOSCH DS160

19. CCTV Hardware:

- a. Cameras:
  - 1) AXIS P3245-LV for indoors and P3245-LVE for exterior applications.
  - 2) AXIS P3717-PLE for 360-degreee applications.
  - 3) AXIS Q6115-E PTZ

20. CCTV Software:

- a. Milestone Expert XProtect is in use and all cameras must connect to it.
- b. UCB provides servers and storage.
- c. Annual server maintenance responsibilities are split between UCB Information Systems and UCB Access Services. Requests for additional information will be provided by UCB Access Services upon request.

21. Coordination with Housing and Dining Services (HDS):

- a. If designing for HDS, refer to **Campus Standard F2020** for additional information pertaining to HDS Integrated Security Standards.

## **B3020 – Painting**

### **Introduction**

This section includes requirement for specifying paints at the University of Colorado-Boulder (UCB) for both interior and exterior applications.

The overall intent of the University is to provide consistency in color and finish throughout the campus.

### **UCB Requirements**

1. General Interior Painting:

- a. Comply with Painting and Decorating Contractors of America “Architectural Specification Manual”.
- b. Paint Products Preferred Manufacturers:
  - 1) UCB has current contract with The Sherwin-Williams Company.
    - i. Pro Mar 200 Zero VOC, Eggshell finish, Base # B20-2600
    - ii. ProMar 200 Zero VOC, Semi-gloss finish, Base # B21-2600
- c. New surfaces: 1 primer coat and 2 finish coats.
- d. Existing surfaces: Minimum 2 finish coats.

- e. If sprayed, provide back roll-on final coat of all walls. Exceptions include mechanical rooms, storage areas, closets and ceilings.
- f. Patch painting is not acceptable. Paint total affected area and terminate at nearest corner or joint.

2. Paint:

- a. Provide waterborne or latex acrylic coatings unless approval is obtained from UCB.
- b. Provide a complete list of proposed manufacturer's products, color identification numbers, manufacturer technical data sheets and MSDS Sheets.
- c. Work with UCB to develop color pallet based on campus standard colors and obtain approval of proposed color pallet prior to completion of design documents.
  - 1) Standard Off-White Color: C. U. Egret Match: Kwal Paint, Base # 2810, Formula = C-6, L-12 per gallon)
  - 2) Testing of submitted products may be required to confirm match to the UCB standard off-white color. Testing may include accurate color match, hiding capabilities, touch-up capabilities, sheen match and other performance characteristics.
- d. Specialty Paints and Paint Systems: Consult with UCB to confirm specified coatings meet the specific application and are consistent with similar campus coatings.
  - 1) Examples include but not limited to floor coatings, high heat and chemical resistant coatings, specialty metal coatings, etc.
  - 2) Submit proposed manufacturers for epoxy coatings, urethane coatings and multi-colored sprayed coatings to UCB.
- e. Volume Solids Contents:
  - 1) When applied at a rate of 400 SF per gallon-obtaining a mil thickness when dry of a minimum of 1.3 mil, the minimum acceptable volume solid content must be A (see list below) minimum and angular specular sheen should be B (see list below).

|                          | <u>A</u> | <u>B</u>    |
|--------------------------|----------|-------------|
| Flat finish              | 38%      | 0-5 @ 60°   |
| Eggshell or Satin finish | 36%      | 10-25 @ 60° |
| Semi-Gloss finish        | 34%      | 30-60 @ 60° |
| Gloss finish             | 34%      | 60-80 @ 60° |

- 2) These apply to both interior and exterior products, with the possible "satin" or "pearl" addition.
- 3) Paint all walls to meet UCB sheen standards for the 10-25 measurement at 60° Eggshell/Satin or 30-60 @ 60°, and volume solids ratings.
- 4) Paint all trim with semi-gloss paint that meets UCB sheen and volume solids ratings.
- 5) A sheen measurement of 85% is not acceptable.
- f. Specialty Areas:
  - 1) Elevator Equipment, Mechanical and Electrical Room:
    - i. Walls and Ceilings: Off white acrylic latex semi-gloss.

- ii. Mechanical Rooms: Epoxy resinous flooring system that is abrasion, impact, and chemical resistant, aggregate filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base. Finish to be semi-gloss and textured for slip resistance.
    - iii. Elevator Equipment and Electrical Rooms: Light grey waterborne finish. Two coats SW ArmorSeal 8100 WB Epoxy
  - 2) Baseboard Radiation Covers:
    - i. Area Inside Metal Covers: Paint flat black or appropriate color to match.
  - 3) Access Flooring:
    - i. Space Beneath Floor Surface: Paint flat black or appropriate color to match.
  - 4) Wall and Ceiling Return Air Grilles:
    - i. Space Behind Grilles: Paint flat black for a distance of 24" from face of grille or appropriate color to match.
  - 5) Exposed Non-Galvanized Iron Pipes and Security Conduit:
    - i. Color to match adjacent wall or ceiling finish.
  - 6) Roof, Wall, or Ground Mounted Equipment:
    - i. Submit color to be approved by UCB.
- 3. Roof equipment visible from ground
  - a. Benjamin Moore Super Spec, Low Lustre
- 4. Ferrous Metals:
  - a. Paint all exposed steel unless otherwise approved by UCB.
  - b. Provide SW6258 Tricorn Black DTM Acrylic Semi-Gloss or equivalent for all exposed ferrous metals and all interior door frames, unless otherwise approved by UCB. Confirm paint formula with UCB.
  - c. Provide one shop coating of Tnemec 10-99 long-oil alkyd primer, SW Steel Spec Universal Primer B50AV8431, or approved substitute to ferrous metals after fabrication.
    - 1) Apply two coats to ferrous metals that will be inaccessible after erection.
    - 2) Shop coating is not included as a coat for finish painting. Shop coating may be omitted on surfaces embedded in concrete or that require field welding.
  - d. Epoxy and urethane finishes may be considered but require approval from UCB.
- 5. General Exterior Painting:
  - a. Provide submittals containing samples, product data, and warranty information for all exterior paints, coatings and associated colors for UCB approval. Provide application information, surface and maintenance requirements. This includes pre-finished components and systems.
  - b. Confirm proper surface preparation and material compatibility to provide weather resistant coatings. Coatings must:
    - 1) Resist corrosion due to salt for surfaces at or near ground level.
    - 2) Resist chipping and peeling.
  - c. Provide SW6258 Tricorn Black DTM Acrylic Semi-Gloss paint for the following applications and confirm additional required exterior applications with UCB:

- 1) Exterior Door Frames
- 2) Exterior Stair Railings

6. Coordination with Housing and Dining Services (HDS):

- a. If designing for HDS, refer to **Campus Standard F2010** for additional information pertaining to HDS Interior Standards.

## **B3030 – Stairs and Railings**

### **Introduction**

This section identifies criteria and preferences for the design and safe construction of stairs, railings, and associated components at the University of Colorado-Boulder (UCB).

This section also includes requirements for interior stair finishes. In addition to these requirements, the intent is for stairs to be consistent in finish with the design of the entire facility. Refer to **Campus Standards B3020, C2010, C2020 and C2030** for campus issues related to painting, walls, floors and ceiling finishes.

### **UCB Requirements**

1. General Stair Design:

- a. Exterior egress stairs from the building are not acceptable for new construction.
  - 1) When code compliance for renovation work dictates an exterior stair, confirm design strategy with UCB.
  - 2) Provide steel grate treads for exterior stairs when applicable.
- b. Hot-dipped galvanized finish is not acceptable due to inconsistency in surface finish.
- c. It is understood that engineered stair construction drawings are often a delegated design performed by the stair manufacturer. All final stair construction drawings must be stamped by a Licensed Professional Engineer.
- d. Because debris tends to collect between stair stringers and adjacent stair well enclosures, install stair stringers tight and flush to stairwell enclosure or provide minimum 4" gap.

2. Stair Construction:

- a. Steel-framed stairs are preferred. For noise considerations, provide pan-tread channel stringer construction with concrete filled sub-treads and platforms.
- b. Where applicable, provide industrial style grate tread channel stringer stairs. Steel grate treads are acceptable for service areas but not acceptable in public spaces.
- c. Alternating Tread Stairs/Devices are not acceptable on campus.

3. Stair Finishes:

- a. Provide painted finishes, wall coverings, tile, stone and other finishes to complement the adjacent finished areas.

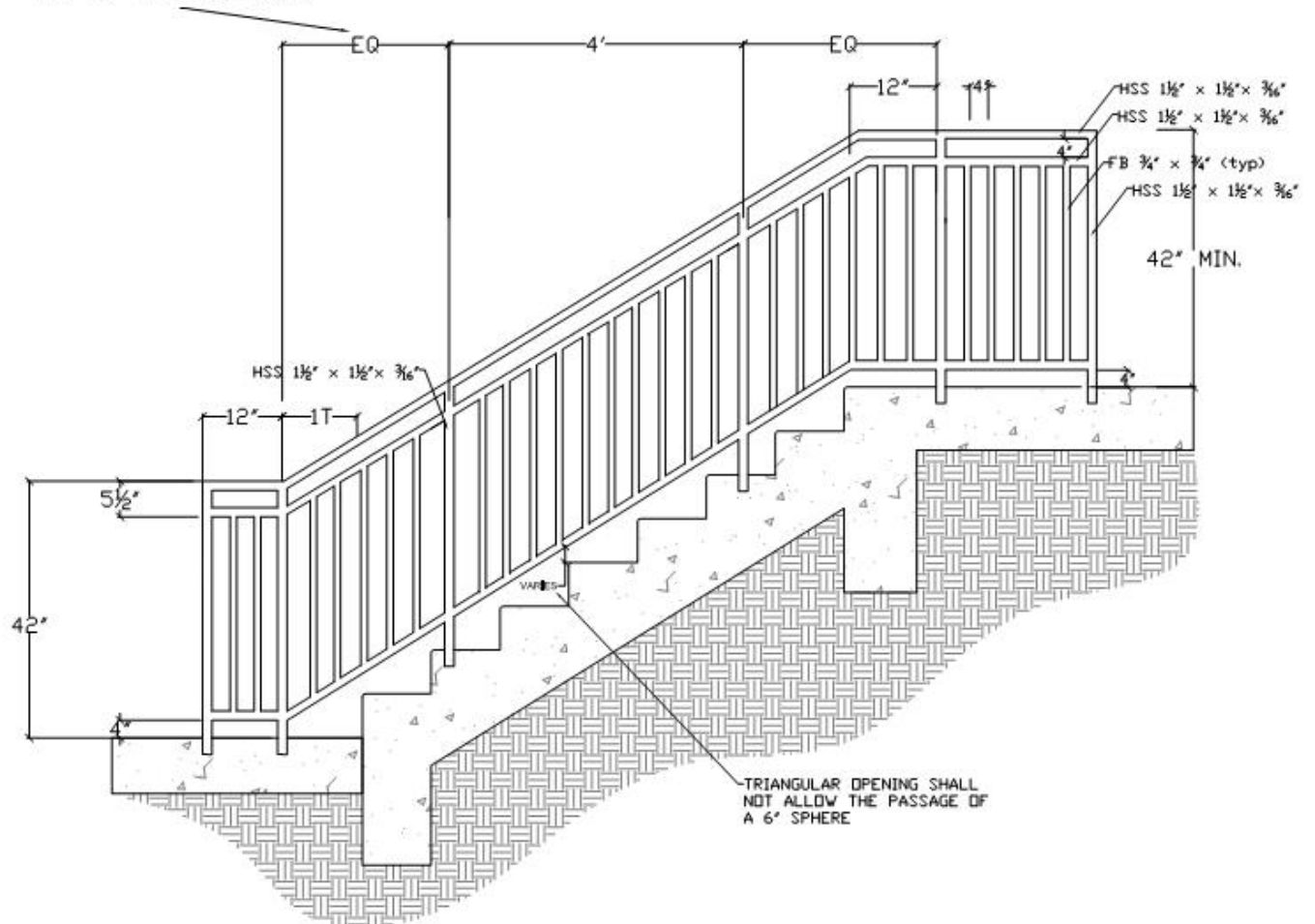


- 1) Provide painted and fully finished spaces in emergency egress stairwells consistent with the interior design of the project.
  - b. Landings, treads and risers:
    - 1) Provide vinyl composition tile, carpet, porcelain pavers, stone, resilient flooring, rubber tile, rubber stair treads, rubber wall base and other durable materials as approved by UCB.
    - 2) Single piece 3/16" gauge minimum stair treads with matching coved base and 0.080" gage sheet rubber stringer skirt may be used.
    - 3) Exposed sealed concrete pans with painted nosings are acceptable in emergency egress stairwells with approval from UCB.
  - c. Underside of Stairs and Landings:
    - 1) Provide painted gypsum wall board or suspended acoustical ceilings beneath landings.
    - 2) Provide painted gypsum wall board or exposed painted steel beneath stair runs.
4. Site Stairs:
- a. Coordinate site stair design with **Campus Standard Section G**.
  - b. Lighting:
    - 1) Provide pole lighting to light exterior stairs, or lighting imbedded into railings.
    - 2) Lights embedded into the riser are not acceptable due to corrosion and maintenance concerns.
  - c. Refer to **Diagrams B3030.1-B3030.5** below for standard campus railing for Site Stairs. Obtain approval from UCB for custom railing designs.
  - d. Provide a Level 2 welding finish on all stair railing welds.

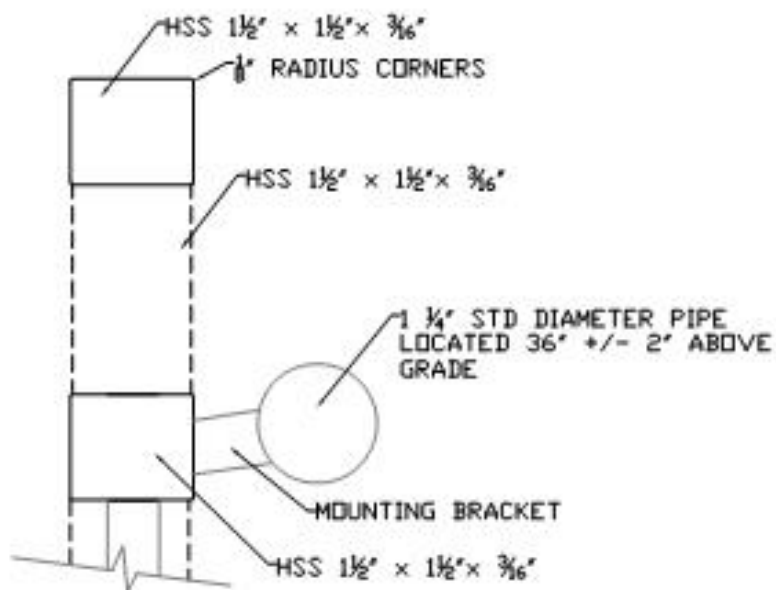


**Diagram B3030.1- Standard Guardrail Design**

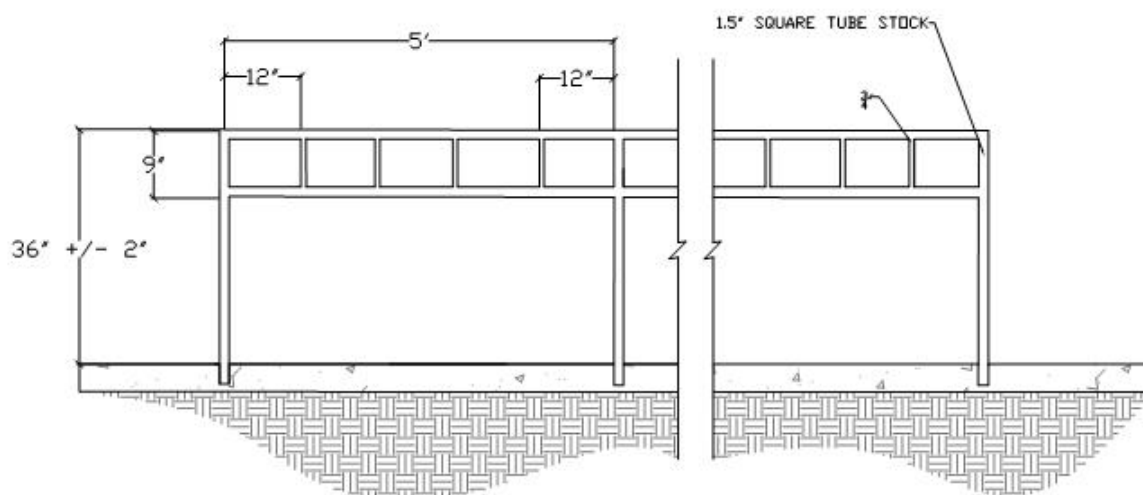
NOTE: AT ENDS 2.0' MIN.  
TO 4.0' MAX SPACING



**Diagram B3030.2 - Standard Handrail Detail**



**Diagram B3030.3 - Standard Barrier Railing**



Technical drawing of a staircase railing system, showing side and front elevations with dimensions and material callouts.

**Side Elevation (Left):**

- Overall height:  $36'' \pm 2''$
- Horizontal distance from wall to start of railing:  $4'$
- Horizontal distance between balusters:  $12''$
- Horizontal distance from wall to first baluster:  $12''$
- Horizontal distance between handrail and balusters:  $1'$

**Front Elevation (Right):**

- Overall height:  $36'' \pm 2''$
- Handrail height above stairs:  $9''$

**Material Callouts:**

- 1.5" SQUARE TUBE STOCK
- 3/4"

5. Ladders:

- a. Paint 'UCB – Warm Black'. Refer to **Campus Standard B3020** for additional painting information.
- b. Reference Standard: Comply with requirements set forth by the Occupational Safety and Health Association (OSHA).

## **C1010 – Interior Partitions**

### **Introduction**

This section includes requirements when designing interior partitions for campus buildings at the University of Colorado-Boulder (UCB).

### **UCB Requirements**

1. General Requirements:

- a. Comply with applicable standards published by the Gypsum Association, except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.
- b. Provide materials from approved manufacturers identified by the Gypsum Association.

2. Gypsum Board:

- a. Finish Levels:
  - 1) Level 2: All concealed gypsum board surfaces.
  - 2) Level 4: All exposed gypsum board surfaces.
- b. Provide 5/8" gypsum board sheets in largest possible lengths and widths to minimize joints.
- c. Accessories:
  - 1) Muddable 'L' metal at all exposed edges meeting different material. 'J' metal not acceptable as it is the campus experience that 'L' metal provides a better transition between finishes.
- d. Joints:
  - 1) Explain clearly where gypsum drywall and accessories must allow for sealant joints.
  - 2) Seal all joints where dissimilar materials intersect unless noted otherwise in the design drawings.
  - 3) Clearly delineate expansion/control joints in the drawings as recommended by manufacturer. Submit proposed decorative joints for approval by UCB.
- e. Soffit framing allowing movement should work consistently from structure above.
- f. Due to durability, cleaning and maintenance concerns, use of gypsum board as finished surface of any horizontal visible surface is not allowed except where approved by UCB.
  - 1) Gypsum board ceilings, soffits and bulkheads are an exception.

3. Impact Resistant Gypsum Board:

- a. Confirm locations of impact resistant gypsum board with UCB. Locations may include corridors and walls near furniture and equipment, but the consultant shall make recommendations for additional locations. Clearly delineate locations in the drawings.
- 4. Conventional Lath and Plaster:
  - a. Reference Standard: USG Plaster Systems Guidelines
  - b. Limit use of gypsum plaster to patching of existing conditions, except as specifically approved by UCB. Match texture to adjacent existing conditions.
  - c. Provide three-coat system.
  - d. For exterior plaster applications and interior plaster applications in “wet” areas, use only Portland cement plaster.
- 5. Veneer Plastering:
  - a. Reference Standard: USG Plaster Systems Guidelines
  - b. Prior to start of plastering, provide a 4’x4’ sample area of specified plaster system to be approved by UCB. Sample can be incorporated into completed work or left in place to judge completed work.
  - c. Provide two-coat application.
  - d. Finish Texture: For sand-float finish, provide white silica sand passing a 30-mesh screen.
- 6. Metal Studs:
  - a. Reference Standard: American Iron and Steel Institute (AISI) S220 North American Standard for Cold-Formed Steel Framing - Nonstructural Members
  - b. When determining metal stud thickness, confirm specified studs are appropriate for use with various building components and systems mounted to or associated with framed wall and consider campus concerns of durability, longevity, and future flexibility.
    - 1) If specifying stud thickness less than .0329”, identify proposed locations and obtain approval from UCB. Campus issues listed below:
      - i. Screws not holding to the stud and resulting in popped heads.
      - ii. Flexibility of use is reduced as structural capacity of stud does not allow for future equipment mounting without adding additional blocking.
  - c. Review requirements of partitions with UCB and make recommendations for extending all or parts of stud framing to deck for new building construction. If extending framing to deck is recommended:
    - 1) Provide slotted deep leg tracks to accommodate deflection of structure as determined by structural engineer.
    - 2) Reference project Geotechnical Report information in construction documents when describing dynamic movement requirements.
    - 3) Submit proposed head of wall detail for fire-rated assemblies to UCB for review.
  - d. For all other renovation projects, brace from top track to structure.
    - 1) Space bracing maximum 4’-0” on center.
    - 2) Provide bracing at every door jamb leg in opposition to direction of door swing.
  - e. Provide a box header with cripples at all openings exceeding 3’-0” width.

- f. Provide horizontal bridging to reinforce stability of framed walls where large or heavy items will be mounted to wall.
  - g. Provide double studs at door jambs and as needed at corners to stiffen and support.
  - h. Space stud framing members maximum 16" on center.
  - i. Confirm that metal stud partitions are of sufficient width to adequately enclose piping, conduits, and recessed equipment.
- 7. Ceramic Tile Substrate:
  - a. Reference Standard: Comply with applicable standards published by the Tile Council of North America.
- 8. Acoustical Performance:
  - a. Reference Standard: USG Acoustical Assemblies Guideline (USG AAG).
    - 1) Refer to STC Guidelines portion of the USG AAG to determine STC ratings between spaces.
  - b. Prior to incorporating acoustic separation requirements based on the USG AAG, confirm expected acoustic performance with UCB.
  - c. Refer to **Campus Standard A0021** for typical room noise criteria and coordinate acoustical requirements with **Campus Standards C2030 and D0000**.
  - d. Acoustic Sealants:
    - 1) Provide at all joints between drywall system and adjoining materials where acoustical performance is required.
    - 2) Clearly describe locations of all acoustic sealant in project documents.
- 9. Insulation:
  - a. Insulate all mechanical rooms for sound attenuation and to reduce heat loss to surrounding spaces.
- 10. Blocking/Rough Carpentry:
  - a. Reference Standard: Comply with applicable standards published by the American Wood Protection Association (AWPA).
  - b. Provide #2 Grade, 2" nominal wood blocking in metal stud framing at all instances where items will be mounted to wall.
  - c. Provide preservative treated wood where installed from 0"-18" above finish floor.
  - d. Provide fire treated blocking as indicated by AWPA.
  - e. Blocking:
    - 1) Wood blocking is preferred for majority of applications.
    - 2) Metal strap blocking will be considered for light duty applications.
- 11. Access Panels:
  - a. Provide minimum 24"x24" access panels in partitions for mechanical equipment,
  - b. Confirm size of access panel with the specified equipment to be served as larger panels may be required.

**12. Coordination with Housing and Dining Services (HDS):**

- a. If designing for HDS, refer to **Campus Standard F2010** for additional information pertaining to HDS Interior Standards, including required acoustical separations.

## **C1020 – Fixed Furnishings and Equipment**

### **Introduction**

This section includes requirements when designing and specifying architectural woodwork, solid polymer fabrications, and casework at the University of Colorado-Boulder (UCB).

This section also includes requirements when specifying residential appliances.

All colors, manufacturers, products and finishes selected by the design consultant will be submitted to UCB for approval.

### **UCB Requirements**

**1. Architectural Woodwork:**

- a. Comply with Architectural Woodwork Institute (AWI) “Quality Standards”, Section 400, Custom Grade. Premium grade will be considered only in specific applications with the recommendation of the design consultant and as approved by UCB.
- b. Veneers (avoid rainforest/environmentally sensitive selections):
  - 1) General campus preference is plain sliced, book matched, white oak.
  - 2) If alternative veneer is approved by UCB, it must be commonly available on the market to ensure future renovation work will be consistent and easily replaced when damaged.
  - 3) For addition and renovation work, match the predominant woodwork (species, slice, matching and color) in the existing facility unless approved otherwise by UCB Campus Architect.
- c. Matching:
  - 1) Between adjacent veneers: Bookmatch.
  - 2) Between individual panel faces: Balanced to panel.
  - 3) Matching or adjacent panels: Sequenced.
- d. Hardwood Lumber:
  - 1) Reference Standard: AWI grading standards for premium grade solid stock.
  - 2) Sapwood is not acceptable.
- e. Hardwood Plywood:
  - 1) Reference Standard: PS 51, premium grade hardwood face veneers.
  - 2) Face and back veneers grade selected in accordance with AWI Standards for premium grade, select for color.
- f. Particleboard:
  - 1) Medium density (45 lbs./cu. ft. minimum) board fabricated from wood chips and phenolic resin binders, compressed board, 3/4” thickness unless otherwise indicated complying with ANSI A208.1, Grade 1-M-3.



- g. Hardboard:
    - 1) PS 58, Class 1 (tempered), smooth one side or both sides where indicated, 1/4" thickness unless as otherwise indicated.
  - h. Medium Density Overlay Plastic Faced Plywood:
    - 1) Provide both faces finished to prevent uneven moisture in panel resulting in warping. Smooth paint grade.
  - i. Fasteners:
    - 1) Nails:
      - i. May be used only for temporary, concealed anchorage.
      - ii. Do not use for gluing pressure.
    - 2) Wood Screws:
      - i. Exterior: Brass
      - ii. Interior: Steel
    - 3) Adhesives:
      - i. Reference Standard: AWI 100-G-12.
  - j. Wood Paneling:
    - 1) Reference Standard: Architectural Woodwork Institute (AWI) "Quality Standards". Sections 200 and 500, Custom Grade. Premium grade will be considered only in specific applications with the recommendation of the design consultant and as approved by UCB Campus Architect.
2. Solid Polymer Fabrications:
- a. Minimum thickness: 1/2"
  - b. Exposed corners to be eased with 1/16" radius.
  - c. Provide seams and joints that are solid and inconspicuous.
  - d. Campus preference is for solid polymer fabricated countertops due to durability concerns; at a minimum provide solid polymer countertops at all locations where a sink is hosted.
  - e. Installer to be licensed by selected manufacturer to ensure sole source responsibility.
3. Plastic Laminated Casework:
- a. Reference Standard:
    - 1) Architectural Woodwork Institute (AWI) "Quality Standards", Section 400, Custom Grade
    - 2) NEMA (National Electrical Manufacturer's Association) LD3-High Pressure Decorative Laminates
    - 3) ANSI/BHMA A156.9 "Cabinet Hardware"
  - b. Finish Materials:
    - 1) Exterior Exposed Faces: Provide high pressure plastic laminate.
      - i. Color: White oak or match existing facility.
    - 2) Interior Exposed Faces: Neutral color polyester or low-pressure melamine.
    - 3) Drawer Bottom: Pre-finished neutral color 1/4" thick hardboard, or 1/2" thick particleboard when mechanically fastened.
    - 4) Cabinet Back: Pre-finished neutral color 1/4" thick hardboard.



- 5) Shelves: Neutral color polyester or low-pressure melamine laminated over particle board on two sides.
- 6) Provide finished backs and sides on cabinets likely to be relocated.
  - i. Finish with plastic laminate to match cabinet fronts.
- c. Edging:
  - 1) Match edging color to exterior exposed face.
  - 2) Cover all exposed edges of door and drawer fronts and countertops with 3 mm PVC.
  - 3) Cover all exposed edges of cabinet box, front edge of shelves, and top of drawer boxes with 1 mm PVC.
- d. Cabinet Construction:
  - 1) Drawers:
    - i. Drawer fronts: Apply to drawer sub-front.
    - ii. Sides: Dadoed or dowelled to receive front and back, glued and mechanically fastened together. Dadoed to receive drawer bottom, unless drawer bottom is to be mechanically fastened.
    - iii. Drawer bottom: Fully housed and glued into sides, back and subfront; or mechanically fastened.
  - 2) Cabinet Back: Mechanically fastened or continuous hot melt glue.
  - 3) Shelves:
    - i. 3/4" thick for cabinets up to 30" wide.
    - ii. 1" thick for cabinets 30" wide and larger.
- e. Countertops:
  - 1) Plastic laminate countertops are only acceptable at dry locations.
  - 2) High pressure plastic laminate bonded to particleboard core.
  - 3) Interior side to be properly balanced with heavy gauge neutral colored backing sheet.
  - 4) Edge Banding: 3 mm PVC hot melt glue applied.
- f. Hardware:
  - 1) Hinges: Confirm selected hinges are rated for the appropriate loading requirements.
  - 2) Pulls: Recessed ABS plastic for drawers and swing doors, mounted from back. Provide two pulls for drawers over 24" wide.
  - 3) Magnetic Catch: Provide two catches on doors over 4' high.
  - 4) Drawer guides:
    - i. Accuride No. 2037-A, 50-pound capacity, Blum 230E, 100-pound capacity, or approved substitute bottom mount type of correct size for drawer depth.
    - ii. Accuride No. 4032, 150-pound capacity, Blum 430E, 100-pound capacity, or approved substitute full extension type for file drawers, lateral file drawers, knee space drawers, and where indicated.
    - iii. Include lifetime warranty.
  - 5) Provide adjustable steel shelf clips, 4 per shelf. Provide predrilled holes in cabinet sides spaced at 1.25" o.c. and not more than 1.5" from shelf edges, 2 pin, self-locking shelf clip.
  - 6) Index Followers: Provide steel rod and plate for all file drawers.

- 7) Drawer and Cabinet Locks: Half-mortise type, disc tumbler and cam bolt, round cylinder only exposed, plated finish, with strike.
    - i. Provide National Lock “RemovaCore” or approved substitute with a minimum of 50 lock changes.
  - 8) Coat Rods: Provide 1.25” diameter chrome plated or stainless-steel tubing.
  - 9) Label Holders: Provide where indicated, size to receive standard label cards approximately 1”x2” nominal size, finished to match other exposed hardware.
4. Metal casework
- a. Review with UCB Planning
5. Architectural Woodwork/Casework Mock-Up:
- a. Mock-ups may be required based on project size and scope. If required, provide full-size base cabinet complete with drawers, hinged door, adjustable shelf, and countertop.
    - 1) Half-size base cabinet may be acceptable for small projects.
6. Residential Appliances:
- a. Provide appliances from manufacturers readily available and serviceable providing quality and campus uniformity expectations.
  - b. Provide appliances with the Energy Star rating.

## **C1021 – Interior Accessories**

### **Introduction**

This section includes requirements when specifying interior accessories for the University of Colorado-Boulder (UCB). Included in this section are toilet compartments, toilet accessories, visual display boards, and building directories.

### **UCB Requirements**

1. Toilet Compartments/Urinal Screens:
- a. Materials:
    - 1) It is important to keep materials and finishes uniform for the cleaning and maintenance of toilet compartments campus wide.
    - 2) Provide 1” depth partitions and 1 1/4” depth pilasters.
    - 3) Solid phenolic partitions are preferred. Metal or solid plastic may be considered.
      - i. If providing metal partitions, provide rust inhibitive primer with baked enamel finish.
      - ii. Plastic laminate partitions are not acceptable.
    - 4) Provide partitions dark in color which address the following properties:
      - i. Long-Term Structural Integrity
      - ii. Rust-Free
      - iii. Graffiti Resistance
  - b. Installation:

- 1) Compartment partitions to be floor mounted and overhead braced.
  - 2) Maximum 1/2" clearance between pilasters and panels.
  - 3) Maximum 1" clearance between panels and walls.
  - 4) Coordinate bracket locations with tile wainscot to ensure an even substrate for anchorage.
  - c. Hardware and Accessories:
    - 1) Hinges: Surface mounted or cut-out inset. Spring loaded, gravity type pivots or spring action cam.
    - 2) Latch and Keeper: Surface-mounted slide latch with rubber faced door strike and keeper.
    - 3) Coat Hook and Bumper: Standard, rubber tipped.
      - i. Provide (2) coat hooks in accessible stalls; provide (1) coat hook in all others.
  - d. Anchoring and Fastening:
    - 1) Provide theft-resistant fasteners for all accessory mountings.
    - 2) Provide concealed fasteners wherever possible.
2. Toilet Room Accessories:
- a. Refer to **Campus Standard A0021** for additional information when planning Toilet Rooms.
  - b. Owner Furnished Contractor Installed (OFCI) dispenser models are typically determined and provided by product vendors contracted with UCB.
    - 1) Confirm current campus vendors with UCB.
    - 2) Refer to **Table C1021.1** for typical OFCI or Contractor Furnished Contractor Installed (CFCI) designations:

**Table C1021.1**

| Accessory                 | OFCI | CFCI |
|---------------------------|------|------|
| Lavatory Mirrors          |      | X    |
| Bookshelf                 |      | X    |
| Sanitary Napkin Disposal  |      | X    |
| Electric Hand Dryers      |      | X    |
| Paper Towel Dispensers    | X    |      |
| Toilet Paper Dispensers   | X    |      |
| Soap Dispensers           | X    |      |
| Hand Sanitizer Dispensers | X    |      |

**Note:** Sanitary napkin/tampon dispensing units are NOT required to be furnished or installed

- c. Verify that accessories provided by both the vendor and contractor are consistent in finish and appearance.
- d. In "wet areas" or areas of high humidity, provide stainless steel accessories including hinges, bookshelves and exposed fasteners.
- e. Verify the depth of all accessories comply with applicable codes pertaining to "protruding objects". It may be necessary to provide alcoves to meet compliance.



- f. Because dispensers, accessories, and other wall mounted fixtures can be changed out every few years, the consultant is expected to provide appropriate clearances and blocking to accommodate a range of common dispensing equipment.
  - 1) Refer to **Campus Standard C1010** for additional blocking requirements.
- g. Coordinate mounting heights with tile wainscots to ensure accessories are either entirely on or entirely off tile. Refer to **Campus Standard C2010** for additional information.
- h. Provide mirrors at all lavatories:
  - 1) Minimum 18" wide x 36" high at single lavatories.
  - 2) Minimum 30" wide x 36" high at double lavatories.
  - 3) 36" high x length of lavatory run where three or more lavatories are present.
  - 4) Mount mirrors above finish floor to meet federal accessibility guidelines.
- i. Provide 12" deep stainless steel bookshelf in each toilet room. Other materials may be considered but require UCB approval.
  - 1) Provide stainless steel brackets securely fastened to concealed blocking.
  - 2) Install in alcove above paper towel dispensers and trash cans.
- j. Sanitary Napkin Disposals:
  - 1) Reference Products:
    - i. Bobrick B-270, Bradley 4-A10, or Bradley 4781-11
  - 2) Provide unit with simple flip lid with flange and no lock.
  - 3) Mount to wall or partition in all women's toilet compartments.
  - 4) Units with drop bottoms are not acceptable.
- k. Electric Hand Dryers are preferred over paper towel dispensers:
  - 1) Consider location of toilet room in relation to offices, classrooms, or other spaces that may be negatively affected by the noise generated by the electric hand dryer.
  - 2) Provide minimum (1) dispenser per lavatory, with (1) additional dispenser for every (2) additional lavatories.
  - 3) If electric hand dryers are cost prohibitive for the project, provide electrical rough-in behind paper towel dispenser to allow for future installation of electric hand dryers.
- l. Toilet Paper Dispensers (Non-Accessible Stall):
  - 1) Mount toilet paper dispenser such that the bottom of dispenser is 30" AFF.
- m. Toilet Paper Dispensers (Accessible Stall):
  - 1) Dispenser to accommodate (4) rolls of toilet paper.
- n. Foam Hand Soap Dispenser:
  - 1) Mount to drywall using screws and anchors. Mounting to drywall with double-sided tape is not acceptable.
  - 2) Mounting to mirrors and tile surfaces using double-sided tape is acceptable.
- o. Hand Sanitizer Dispenser:
  - 1) Provide (1) per building, at main entrance only.
  - 2) Mount to drywall using screws and anchors. Mounting to drywall with double-sided tape is not acceptable.
- p. Keying:
  - 1) Provide locks of the same key type for each accessory. Confirm lock type with UCB.
  - 2) Provide two keys for each lock to UCB.

**3. Visual Display Boards:**

- a. Provide all visual display boards by one manufacturer for the entire project.
- b. Confirm preference for white glass, markerboard, chalkboard or television/monitor displays with UCB.
- c. If televisions or monitor displays are required, work with UCB OIT to confirm selection. Identify mounting strategies to comply with protruding element code requirements and consider a wall box to provide connection points to eliminate draping cords and cables.
- d. If televisions or monitor displays are touch-screen operable, confirm mounting heights meet accessibility reach height requirements. Refer to **Campus Standard A0040** for additional information.
- e. Chalkboards and Markerboards:
  - 1) 1/2" minimum thickness.
  - 2) Provide a high-fired, ceramic-covered steel, dry marker writing surface.
  - 3) Do not use 'T' astragal or any aluminum trim between sections that would break up the writing surface.
  - 4) Trim: Provide tackable strip full length at top of boards and include map holders.
    - i. Wood trim to be used only with approval of UCB Project Manager or to match existing building conditions.
  - 5) Verify with UCB if any silk-screened images are required on boards.
  - 6) Surface mount with chalk/marker rail, map holders, and two moveable flag holders.
  - 7) Install chalkboards and markerboards placing chalk tray at 36" AFF; top of board no higher than 7'-0".
  - 8) 'Chalk-in' all chalkboards prior to acceptance.
  - 9) Colors:
    - i. Chalkboards: Preference for black, then charcoal. Green is not desired.
    - ii. Markerboards: White, magnetic.
- f. Operable Boards:
  - 1) Equip each operable panel to produce smooth and easy operation.
  - 2) Provide solution that eliminates dark shadows on the back surface cast by the front operable board.
  - 3) Provide easy access to screws, cables and pulleys on chalkboards and removable trim.
- g. Tackboards:
  - 1) 1/4" cork or vinyl fabric over 1/16" cork.
  - 2) 1/2" minimum total thickness; provide fiberboard backing as necessary.

**4. Coordination with Housing and Dining Services (HDS):**

- a. If designing for HDS, refer to **Campus Standard F2010** for additional information pertaining to HDS Interior Standards.

## **C2010 – Wall Finishes**

### Introduction

This section includes requirements when designing and specifying interior ceramic tile and wall coverings at the University of Colorado-Boulder (UCB). Refer to **Campus Standard B3020** for painting requirements.

Verify all selected finish materials are compatible with UCB cleaning products and methods.

### UCB Requirements

#### 1. Ceramic Tile:

- a. Reference Standard: Comply with applicable standards published by the Tile Council of North America “Handbook for Ceramic Tile Installation”.
- b. Performance Criteria:
  - 1) Provide Grade 2 or 3 for wall installations.
- c. Provide tile wall finish on restroom walls behind sinks, urinals and toilets, designed to withstand typical UCB high-pressure cleaning methods.
  - 1) Provide aluminum transition strip from tile wall finish to tile floor finish.
- d. Coordinate tile wainscots with all wall mounted equipment, accessories (including UCB furnished items) and toilet partitions to ensure mounting of these items does not straddle wainscot. The height of the tile wainscot is to stay consistent, no ‘picture framing’ around any wall-mounted accessory.

#### 2. Wall Coverings:

- a. Reference Standard: Comply with applicable standards published by the Wallcoverings Association (WA), except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.
- b. Textile wall coverings may be used in special locations as approved by UCB.
- c. Wallpaper is not acceptable.

#### 3. Coordination with UCB Housing and Dining Services (HDS):

- a. If designing for HDS, refer to **Campus Standard F2010** for additional information pertaining to HDS Interior Standards.

## C2020 – Floor Finishes

### Introduction

This section includes requirements when designing and specifying ceramic tile, wood flooring, resilient flooring, carpet and terrazzo at the University of Colorado-Boulder (UCB).

Coordinate with UCB Building Services to verify all selected flooring products are readily available in small quantities within the region and compatible with UCB cleaning products and methods.

### UCB Requirements



1. Tile Flooring:

- a. Comply with applicable standards published by the Tile Council of North America "Handbook for Ceramic Tile Installation"
  - 1) Confirm coefficient of friction and slip resistance with TCNA standards.
- b. Design to withstand typical UCB high-pressure cleaning methods.
  - 1) Provide aluminum transition strip from tile wall finish to tile floor finish.
- c. Use tiles with a minimum of 144 in<sup>2</sup> to reduce grout joints and minimize potential of standing water.
- d. Use grey or black grout in restrooms.
- e. Provide for thick-set installation for showers and other demanding applications.
- f. The floor is to be stripped, scrubbed and the application of a minimum of two coats of grout sealer for completion. Confirm specified grout sealer with UCB.
- g. Sealers:
  - 1) Provide non-metallic, acrylic based product, confirm selection with UCB.

2. Wood Flooring:

- a. Comply with applicable standards published by the National Wood Flooring Association (NWFA), except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.
- b. Limit use of wood flooring to athletic, recreational or performing arts applications. Any use other than historical use requires approval from UCB.
- c. Provide wood species which are readily available within the region.
- d. Provide life-cycle analysis to UCB comparing waterborne finishes to solvent-based finish.
  - 1) Finishing materials to be compatible with flooring manufacturer requirements.

3. Polished concrete floor:

- a. Comply with the American Concrete Institute's 310.1 standards for polished concrete floors.

4. Resilient Flooring:

- a. Comply with applicable standards published by the Resilient Floor Covering Institute (RFCI), except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.
- b. Solid colors are not acceptable unless approved by UCB Campus Architect.
- c. Sheet flooring products are not acceptable.
- d. Vinyl Composite Tile (VCT):
  - 1) Provide 12" x 12" minimum for ease of maintenance and replacement.
  - 2) Provide larger tile if product is readily available and application is suitable.
  - 3) Limit use of VCT in high moisture applications as recommended by RFCI.
- e. Rubber Flooring:
  - 1) Due to durability concerns and flooring being ripped or gashed, rubber flooring is not to be used for corridors/hallways/high traffic areas. Product is suitable for interior of labs only.
  - 2) Provide 36" x 36" tiles if product is readily available and application is suitable.
  - 3) Provide 24" x 24" tiles if 36" x 36" tiles are not suited for the application.



- f. Resilient floors to be stripped/scrubbed and a minimum of four (4) coats of approved sealer/finish.
  - g. Match adjacent stair finishes with flooring selection. See **Campus Standard B0030** for additional information pertaining to stair finishes.
  - h. Wear Layer:
    - 1) As directed by UCB Project Manager, provide life cycle analysis to UCB pertaining to initial cost, wear layer, and manufacturer's warranty.
- 5. Wall Base:
  - a. Provide dimensions of 1/8" depth x 4" high.
  - b. Provide base without cove for carpet and coved base for all other locations.
    - 1) Toe base/toe-less straight bases allow for a level of continuity in regard to installation, routine floor care, as well as accommodating for storage issues.
  - c. Provide pre-formed or molded internal and external corner units.
- 6. Carpet:
  - a. Confirm current UCB Sole Source agreements with carpet manufacturers. Refer to **Campus Standard A0020** for additional information on product specification based on sole source descriptions.
  - b. Reference Standard: Comply with The Carpet and Rug Institute "Standard for Installation of Commercial Textile Floor-covering Materials" and "Green Label Plus Indoor Air Quality Testing Program".
  - c. Reference Products:
    - 1) Carpet Tile: Interface. Another carpet tile may be considered by UCB, but the Design Consultant must demonstrate how the proposed product meets or exceeds the properties Interface Verticals Collection provides, listed below:
      - i. Durability and wear properties complying with UCB maintenance concerns.
      - ii. Product must be able to be procured in small orders to minimize the amount of carpet tiles UCB needs to maintain in building stock.
      - iii. Product must withstand not only to stains from coffee and soda spills, but also to the negative impact caffeine has on the plastics within the carpet material.
    - 2) Broadloom: Tandus
      - i. Provide only in specialty areas confirmed with UCB.
  - d. Colors:
    - 1) Due to concerns of stain resistance and long-term durability, do not provide colors other than medium to dark range. Confirm selected colors and patterns with UCB.
    - 2) Provide carpet with maximum stain resistance to coffee and soft drink spills.
  - e. Yarn and Construction Method for High Traffic Areas – Classrooms, Common Areas:
    - 1) Yarn: 100% type 6, 6 bulk continuous filament (BCF) nylon. Hollow filament fiber shape for optimal soil hiding capability. Modification ratio of less than 1.5. Fiber. Polymer type identification to AATCC TM 20 (no substitutions allowed).
    - 2) Construction: Level loop or textured loop with maximum pile height variation of 1/32 inch.



- 3) Dye method: minimum of 75% solution dyed.
  - 4) Pile Weight: Minimum 17 oz/yd<sup>2</sup>, ASTM D5848 test method.
  - 5) Colorfastness to Light: AATCC TM 16 part 3 to 80 AFU; minimum rating of 3-4 using AATCC Gray Scale for Color Change.
  - 6) Soil Resistance: Soil resistance treatment to be heat cured by mill during carpet manufacturing process.
  - 7) Coloration/Patterning: Minimum 4 color hues. Recommended: Hue values to be in medium to medium-dark range with random or complex patterning for optimum soil hiding capability. Restrict solid color carpet to accent areas. Do not use light colors.
- f. Yarn and Construction Method for Low Traffic Areas – General Use, Offices:
- 1) Yarn: 100% type 6 or 6, 6 bulk continuous filament (BCF) nylon with modification ratio of less than 2.0 fiber, polymer type identification to AATCC TM 20.
  - 2) Construction: level loop, multi-level loop, or tip sheer
  - 3) Dye method: Solution dyed fiber or yarn dyed or combination of both
  - 4) Pile Weight: Minimum 14 oz/yd<sup>2</sup>, ASTM D5848 test method
  - 5) Stain Resistance: AATCC TM 171 (HWE) for 2 cleanings to simulate removal of topical treatments by hot water extraction, followed by AATCC TM 175 Stain Resistance test; minimum rating 7 using AATCC Red 40 Stain Scale.
  - 6) Coloration/Patterning: Minimum four (4) color hues. Recommended: Hue values to be in medium to medium-dark range with random or complex patterning for optimum soil hiding capability. Restrict solid color carpet to accent areas. Do not use light colors.
- g. Primary and Secondary Backings:
- 1) Classrooms: Moisture impermeable sheet backing system with welded seams.
- h. VOC Limits:
- 1) Meet all applicable code required VOC requirements.
- i. Adhesive:
- 1) Adhesive shall be water-resistant, mildew-resistant, non-staining, non-gassing type as recommended by the manufacturer.
- j. Verify electrostatic propensity requirements at computer rooms.
- k. All transition strips to be approved by UCB staff prior to installation. Preferred low profile, high weight and traffic, glued down rubber material transition strips.
7. Terrazzo:
- a. Comply with applicable standards published by the National Terrazzo and Mosaic Association (NTMA) except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.
  - b. UCB has had good experiences in using terrazzo on floors in high traffic areas. Terrazzo is an extremely durable product and is recommended for design consideration in corridors, lobbies, and restrooms in heavily used facilities, budget permitting.
  - c. Installers are limited to companies specializing in “full bed” terrazzo applications with documented experience and a member of the NTMA.
  - d. System Requirements:



- 1) 3/4" total terrazzo minimum thickness.
  - 2) Provide reinforcing mesh, minimum 2" x 2" x 16 gauge, galvanized.
  - 3) Provide aluminum oxide non-slip aggregate to match surface aggregate.
  - 4) Provide 1/4" width, zinc topped control and divider strips. Maximum placement not to exceed 8'-0"x8'-0".
  - 5) Choose an aggregate and matrix color that is easily maintainable and that does not accentuate dirty surfaces during wet weather conditions.
  - 6) Provide cove terrazzo bases where terrazzo is used as a flooring material.
  - 7) Provide 1/4" sand cushion over the structural floor substrate.
  - 8) Terrazzo used on step treads shall be crossed grooved or have a rough finish imbed a minimum of 2" wide at the stair nosing, running the length of the tread.
8. Sealers:
- a. Consult with UCB Facilities Management to confirm specification of sealer.
    - 1) Provide a minimum of four (4) coats of approved sealer/finish.
9. Coordination with UCB Housing and Dining Services (HDS):
- a. If designing for HDS, refer to **Campus Standard F2010** for additional information pertaining to HDS Interior Standards.

## C2030 – Ceiling Finishes

### UCB Requirements

1. General Ceiling Design:
  - a. Comply with applicable standards published by the Ceilings and Interiors Systems Construction Association (CISCA) except where more detailed or more stringent requirements are indicated, including the recommendations of the manufacturer.
  - b. Clearly identify the ceiling grid layout centered or evenly spaced within the specific rooms or areas.
    - 1) Balance the border widths at opposite edges of each ceiling.
    - 2) At the borders, avoid the use of units less than half of the tile width.
  - c. Verify minimum clearances required from top of grid or structure to plenum hosted equipment.
  - d. Coordinate ceiling design with mechanical equipment and building systems to ensure grills, diffusers, light fixtures and other ceiling accessories are:
    - 1) Not laid directly onto the grid and supported independently of the ceiling grid with proper suspension wires.
    - 2) Specified with mounting to match ceiling tiles and suspension system. Verify compatibility with tegular-edge panels, if used.
  - e. Coordinate ceiling grid layout with other building systems.
2. Suspended wood ceiling

- a. Approved by variance process only
  - b. Design team to consider access needs for maintenance when specifying
3. Acoustic Ceiling Tile:
- a. Consistency in ceiling tile color and style simplify maintenance of facilities and replacement of damaged tiles. Due to maintenance concerns and goals for aesthetic continuity when matching existing spaces, UCB limits specification of acceptable ceiling tile to three (3) manufacturers listed below:
    - 1) Armstrong World Industries, Inc.
    - 2) Celotex Building Products
    - 3) USG Interiors, Inc.
  - b. Performance Criteria for ceiling tiles in classrooms, offices and general facilities:
    - 1) NRC: .70 minimum
    - 2) CAC: 38 minimum
    - 3) Surface Texture: Fine
    - 4) Light Reflectance: .86 minimum
  - c. Analyze project-specific programming and identify applications listed below or other applications which may require special consideration:
    - 1) Special Acoustic Applications: Provide acoustic performance criteria of proposed tile to UCB for review.
    - 2) Anti-Microbial Coatings
    - 3) Areas of High Volume of Positive or Negative Air Flow: Provide vinyl-faced gypsum board tiles which will not easily be sucked or blown out of module.
  - d. Tile/Grid Module:
    - 1) Preferred dimensions are 24"x24".
    - 2) Obtain approval from UCB if proposing a module size other than 24"x24".
    - 3) 24"x48" module may be considered.
  - e. Preferred tile is 3/4" thick square edge panels. Obtain approval from UCB if proposing tegular-edge panels.
  - f. Confirm the selected ceiling tiles are both readily available in the region and in small quantities, as individual ceiling tiles are commonly replaced.
4. Suspension Grid System:
- a. Reference Products:
    - 1) Provide USG Donn ceiling grid, due to durability concerns and ability to be dismantled and reused.
    - 2) Provide 15/16" grid.
  - b. Concealed-spline ceilings are not acceptable.
  - c. Confirm structural capacity of grid in areas required to receive heavier tiles.
5. Gypsum Board Ceilings:
- a. Refer to **Campus Standards C1010** for ceiling assembly information and **Campus Standard B3020** for painting requirements.



6. Coordination with UCB Housing and Dining Services (HDS):
  - a. If designing for HDS, refer to **Campus Standard F2010** for additional information pertaining to HDS Interior Standards.