STRUCTURAL SYSTEMS NARRATIVE

Design Codes and Loads

Design of structural elements and systems shall be based on the requirements of the 2006 International Building Code (IBC), Minimum Design Loads for Buildings and Other Structures (ASCE 7-05), all applicable Kit Carson County amendments to the structural portions of the Code, and all Public Schools technical requirements. Special inspections of structural elements during construction shall be based on the requirements of the 2006 International Building Code (IBC), Chapter 17.

Structural elements and systems shall be designed for the following live loads:
- Occupancy........................................E (Structural Occupancy Category III)
- Classrooms.................................40 psf
- Gymnasium .................................100 psf
- Stairs, Corridors, Public Spaces........100 psf
- Corridors above First Level Floor......80 psf
- Storage.........................................125 psf
- Roof - Snow..................................30 psf (plus drifting)
- Lateral – Wind...............................100 mph (3-second gust), Exposure C
- Lateral – Seismic.............................Design Category B

Structural Materials

Concrete

Material Codes: Building Code Requirements for Reinforced Concrete (ACI 318) and Specifications for Structural Concrete for Building (ACI 301)

Normal-weight, stone concrete, typical.

Type I/II modified cement at foundation elements and for all concrete in contact with soil; use Type I cement elsewhere. Per the geotechnical report, severe sulfate exposure is expected.

Concrete Strengths:
- Footings.................................4,500 psi, w/c=0.45
- Stem walls ...............................4,500 psi, w/c=0.45
- Pilasters & Pedestals...............4,500 psi, w/c=0.45
- Interior slabs-on-grade.............4,500 psi, w/c=0.40

Air-entrainment to be 4 to 7 percent by volume.

Cement shall have a tricalcium content of not more than 8 percent.

Fly Ash: To be 20% of cementitious material

Reinforcing:
- Primary bars shall be Grade 60
- Ties, stirrups and field-bent bars shall be Grade 40

Structural Steel


Steel wide flange shapes shall conform to ASTM A992, 50 ksi yield.
Hollow steel section rectangular shapes shall conform to ASTM A500, Grade B, 46 ksi yield.

Channels, angles, bars and plates shall conform to ASTM A36.

Connections shall be bearing-type using ¾-inch diameter, snug-tight, ASTM A325 bolts.

Primer paint is only required on structural steel elements exposed to permanent view.

Base plate and bearing plate grout: 7,000 psi non-shrink, non-metallic

Structural Masonry
Material Code: Specifications for Masonry Structures (ACI 530)

Structural Concrete Masonry Units (CMU) shall be standard, lightweight, 8" (nominal) x 8" x 16" concrete units and shall conform to ASTM C90.

Type S mortar, typical.

Minimum compressive strength of all masonry wall prism assemblies ($f'_m$) shall be 1500 psi based on net bedded area.

Strength testing of assembled prisms is required.

Light-Gage Steel Studs
Material Code: American Iron and Steel Institute Standard AISI S100

Studs 16 gage and heavier shall conform to ASTM A570, 50 ksi yield.

Studs 18 gage and lighter shall conform to ASTM A570, 33 ksi yield.

Galvanized finish for all light-gage studs and associated components.

Earthwork/Site Soils Preparation

A soils report has been prepared for the project site by Terracon dated February 6, 2014 which gives options for both spread footing and drilled pier options. For this narrative, it is assumed that the project will make use of a spread footing foundation system.

The footings will be supported on properly moisture conditioned and compacted imported structural fill. Continuous footings are to bear on a minimum of 3 feet of compacted fill and column pad footings are to bear on a minimum of 5 feet of compacted fill.

Interior slabs-on-grade will also be supported on one of the above soils. Slab edges shall be isolated from building foundation elements and interior walls built directly on the slabs-on-grade shall be constructed to allow for potential vertical movement in the slabs. Slabs are to bear on a minimum of 2 feet of compacted fill.

Foundation and Floor System
Interior First Level Floor slabs shall be 4-inch thick polypropylene fiber reinforced concrete poured over soils as described above. Slabs shall have saw-cut or formed control joints in each direction spaced at 10 feet (+) in each direction. A vapor retarder/barrier shall be installed below slabs at areas with moisture sensitive finished floor coverings as determined by the Architect.

Typical exterior walls shall be supported on 14-inch thick by 3-foot deep reinforced concrete stem walls. Stem walls shall be supported on and doweled to continuous reinforced concrete spread footings.

At exterior masonry walls shall be supported on 18-inch to 20-inch thick by 3-foot reinforced concrete stem walls. Stem walls shall be supported on and doweled to continuous reinforced concrete spread footings.

Exterior building columns shall be supported and centered on rectangular reinforced concrete pilasters built integrally with stem walls. Pilasters shall be supported and centered over spread footings. Top of pilasters shall be 8 inches below the top of interior floor slab.

Interior building columns shall be supported on isolated reinforced concrete spread footings. Top of interior footing shall be 8 inches below top of interior floor slab.

**Exterior Walls**

Typical exterior wall system shall be 4-inch masonry veneer tied back to 6” deep 16 to 18 gage light-gage cee studs extending from new foundation elements below to the top of the new parapet above; studs shall be connected to roof framing elements. Support masonry veneer over openings with steel loose lintel angles. Areas with high roofs may require 8” deep studs.

Where masonry veneer wall does not occur, provide storefront or curtain wall engineered by others extending from the top of new foundation elements to framing elements above.

At exterior load-bearing walls shall be 4-inch masonry veneer tied back to and supported by 8-inch concrete masonry unit (CMU). CMU shall be reinforced with grouted vertical cells at opening jambs, wall ends, wall corners, and at a uniform horizontal spacing. Continuous horizontal joint reinforcing shall be spaced vertically at 16 inches on-center. Continuous solid grouted reinforced bond beams shall be installed above wall openings, below roof framing member bearing elevation, and at top of wall. Masonry over door and window openings in wall shall be supported by multiple steel loose lintel angles as required bearing on jambs. Any veneer over lower adjacent roofs will be supported by continuous L8x8 ledge angles with expansion anchors into grouted CMU spaced at 24 inches on center. Full-depth vertical control joints shall be spaced at 25 feet on-center.

**Building Columns**

Typical exterior columns shall be HSS 5x5 or HSS4x4.

Typical interior columns shall be HSS5x5 or HSS 6x6.

**Floor Framing System**
Elevated floors at mechanical mezzanines shall be 4-inch uniform thickness, normal-weight, concrete slab on 1½-inch deep by 20 gage Vulcraft type 1.5VL or VLI composite steel deck with galvanized finish. Deck shall span between wide-flange steel beams; slab shall be reinforced with #3 @ 18” each way installed ¾-inch clear from top of slab on chairs.

Wide-flange steel beams shall span between perimeter masonry walls or wide-flange steel girders and shall be spaced at 6 to 7 feet on-center. Beams and girders shall have ¾-inch diameter by 3” long headed anchor (shear) studs centered on and welded to beam top flanges; studs shall be spaced at 6 to 24 inches on-center.

Welded L4x4 frames shall be installed at four sides of floor openings smaller than 4-foot on-a-side; frames shall span between adjacent floor framing members.

**Roof Framing System**

Typical roof deck shall be 1½-inch deep by 20 gage wide-rib, painted Vulcraft type 1.5B steel deck spanning between roof framing elements. Deck shall be connected to framing elements with 5/8-inch diameter puddle welds and shall be interconnected at side laps with self-drilling, self-tapping screws. Deck shall span over two or more supports.

Typical roof framing shall be K and KCS-series open-web steel roof joists. Joists shall span between exterior and interior steel wide-flange roof beams and girders and load-bearing CMU walls and shall be spaced at 5'-0"+. Joists shall be primed with joist manufacturer’s standard primer paint. Standard bridging between joists shall be per SJI requirements. Joist top and bottom chord and bridging member sizes shall be provided in accordance with the building’s fire-rating assembly requirements.

Exterior and interior steel wide-flange beams and girders shall span between building columns and/or load-bearing CMU walls. At CMU walls, beams shall bear on and be connected to embedded steel plates set into pockets.

Where required, continuous edge L4x4, L4x3, and/or L3x3 shall be expansion or epoxy bolted to the interior face of CMU walls.

Welded L4x4 frames shall be installed at four sides of roof openings larger than 1-foot on-a-side; frames shall span between adjacent roof framing members.

**Lateral Load Resisting System**

The typical wind and seismic lateral-load resisting system shall be inverted chevron-type or diagonal-type braced bays with steel tube diagonals installed between adjacent building columns. Braced bays shall be located in exterior and interior walls and shall be spaced at 50'-0" to 60'-0" in each direction.

Where braced bays cannot be installed because of wall openings or penetrations, steel moment-resisting frames shall be provided. Frames shall be comprised of steel tube or wide-flange building columns with wide flange floor or roof beams spanning between columns. Beams shall be connected to columns with bolts at steel shear tabs and full penetration welds of top and bottom flanges to face of column.
Where available, the load-bearing CMU walls will serve at the lateral-load resisting system.

**Interface With Existing Building to Remain**

The existing gymnasium structures will remain as part of the project. The western structure is a load-bearing masonry building with open web steel joist roof. The eastern building is a pre-engineered metal building. In both cases, the new structure will be structurally independent from the existing buildings from foundation to roof. At the east of the existing gymnasium, the new building will be taller than the existing structure and the existing metal building will need to be strengthened to provide adequate capacity for the snow drift imposed by the adjacent taller structure. The reinforcement will be additional roof purlins between the existing purlins of the same depth and gage of metal, and steel plates welded to the existing metal building frame.

**Interior Stairs**

Typical interior stairs shall have concrete filled pans with closed risers spanning between steel tube, channel, or plate stringers. Stringers shall be supported by floor slabs and floor framing elements or shall be expansion bolted to adjacent solid grouted CMU wall elements.

Intermediate landings shall be 4-inch uniform thickness, normal-weight, concrete slab on 1½-inch deep by 20 gage Vulcraft type 1.5VL or VLI composite steel deck spanning between steel framing elements and/or stiffening angles as required.

The design and detailing of stairs, landings, supporting elements specifically for stairs and landings, and handrails shall be by the stair supplier.

**Miscellaneous Structure**

There are miscellaneous structural elements that have not yet been defined, which may include entry canopies, sun shades, clerestory roof elements, or architecturally exposed structural elements.