City of Boulder
Public Works/FAM Dept.
P.O. Box 791
Boulder, CO 80306

Structural Condition Assessment

The Carnegie Library
1125 Pine Street
Boulder, Colorado

Nicol Associates Project No. 04082
January 6, 2005

3.0 Structural Condition Assessment (Ref. Photos #1 thru #25)

3.1 Site

The building is located on a moderately sloping site, sloping generally from north to south and from west to east. The main level at the south end of the building is approximately four feet above the exterior finished grade. An exterior concrete sidewalk, entry steps, and a planting area border the south end of the building. A 2 ft. wide handicap walkway extends diagonally across the south setback and connects the main entry walk to an east handicap access ramp (Ref. photo #1).

The north end of the building consists of two levels with the lower (basement) level at approximately four feet below the exterior finished grade at the northeast corner. The lower level mechanical room at the northwest corner is approximately eight feet below the exterior finished grade. An asphalt paved alley borders the north end of the building (Ref. photo #2).

The east side of the building is bordered by a sloped coarse graveled surface extending the full length of the building. A 3 ft. wide concrete paved wheelchair ramp is located immediately adjacent to the east exterior wall, extending north from the southeast corner of the building to the east handicap entrance. The ramp narrows at each end to 2'-6'' wide to accommodate 6 inch masonry projections from the building's exterior wall. (Ref. photo #3).

The west side of the building is bordered by a 4 feet wide terraced ground surface. The upper north end of the terrace is paved with flagstone steps for a distance of approximately eleven feet, at which point the ground surface steps down approximately two feet across a wood box planter to a lower sloping terrace. The lower terrace is covered with a coarse gravel surface, which extends to the southwest corner of the building. A stacked stone retaining wall, varying in height from 18 inches to four feet, borders the west edge of the terraced ground surface. Portions of the retaining wall are dry stacked and portions are mortared. A chain link fence extends along the top of the northern portion of the stone retaining wall (Ref. photos #4, 5, & 6).

A 4 ft. high brick masonry retaining wall borders the west side of the building setback, extending four feet west from the south entry steps, turning south and extending approximately 17'-6'' to the public sidewalk (Ref. photo #7).

The south entry walkway, steps, and associated handrails are in poor condition and should be replaced (Ref. photo #8). The diagonal handicap walkway is likely in violation of the ADA requirements and also should be replaced.

The east wheelchair ramp will likely require some modification at the north and south ends to meet minimum ADA requirements.

It is unclear whether the stone retaining wall, which extends along the west edge of the property is a part of the Carnegie property. In any event, the retaining wall is in poor condition and should be replaced as should the "planter box" step separating the two terrace levels.

The brick retaining wall located along the west edge of the building's south setback is in poor condition and should be replaced.

3.2 Foundation

The building is founded on the site's natural soils. The perimeter exterior walls are load-bearing masonry walls extending to the bearing soils and forming a 3 ft. to 4 ft. high crawl space beneath the main level. The perimeter wall at the crawl space is approximately 17 inches thick except at the south façade where the wall thickness is expanded to approximately 4 ft. to 5 ft. thick. Also, a 3½ ft. thick x 8½ ft. long portion of wall occurs along the west wall at the fireplace location. The south façade portion of the perimeter wall appears to be supported on a continuous concrete slab. Cavities (one in the east perimeter wall and two in the south perimeter wall) were observed from the crawl space. The east wall cavity penetrated the wall approximately 8 inches while the south wall penetrations were more on the order of 3 to 4 feet (Ref. photos # 9, 10, & 11).

The interior of the main floor structure is supported on a continuous 13-inch thick stone masonry wall located at the center of the crawl space and extending in a north-south direction (Ref. photo #12). The center wall is approximately 2'-8'' high at the portion located beneath the main level and bears on a continuous 20 inch wide x 12 inch deep concrete footing. The wall is interrupted by a 3 ft. wide, wood framed, ventilation duct at a location approximately 34 feet from the interior face of the south perimeter wall (Ref. photos #13 & 14).

One other large penetration for metal ductwork was observed along the length of the wall (Ref. photo #15). Various other small diameter penetrations were observed in the interior foundation wall.

The south portion of the main level floor structure is currently supporting library book stacks. To accommodate the heavier book stack loads, 8''x 8'' wood beams were added beneath the main level, in the south crawl space area. The beams are supported on various combinations of stacked stonework, wood posts, and adjustable steel posts. The steel posts are in turn, supported on stacked 2x12 wood pads (Ref. photo #16).

Concrete spread footings are located in the north crawl space areas of the building and are supporting various concentrated loads from the building above.

There is no evidence to suggest that a sub-surface drainage system exists along the north, west, and south sides of the building foundation. These portions of the site appear to be exposed mainly to ground surface water run-off, which is accomplished by the sloped contours of the finished grades.

Two downspouts are connected to the roof gutter, which extends along the east edge of the roof at the north end of the building. The downspouts penetrate into the ground and are believed to be connected to a below grade drainage system, which extends along the east side of the building.

It is my opinion that the building foundation is in fair condition. Although, the foundation elements are generally structurally sound and appear to be performing as intended, there are some isolated areas of concern:

- A significant diagonal crack is present in the east foundation wall near the southeast corner, indicating a likely early settlement of the foundation has occurred in that area (Ref. photos #17 & 18). Evidence of similar activity is present at the southwest corner, including past mortar repair work along the upper north vertical edge of the southwest corner pilaster (Ref. photo #19).

- Similar signs of settlement of the foundation are present at the exterior corner of the building near the northeast entry (Ref. photo #20).

- Cavities in the exterior foundation walls represent a potential for concentration of stresses related to normal foundation movement and should be sealed with brick and mortar (Ref. photos #9, 10 & 11).

- The rough openings in the center stone masonry bearing wall were made over-size for the wood framed and metal ducts and should be filled in to the faces of the duct walls (Ref. photos #13 & 15).

- Where the framed duct penetrates the center stone masonry wall, a flush-framed header should be added above the existing continuous wood top plate (Ref. photo #14).

- The aforementioned wood beams appear to be performing satisfactorily, however, the stone supports appear relatively unstable and should be replaced or supplemented with adjustable steel posts where only stone supports exist. The 2x12 wood pads should be pressure treated to prevent long-term decay.

3.2 Structural Systems

The general structural systems consist of brick masonry load-bearing perimeter walls supporting conventionally framed structural wood floors and conventionally framed wood roof trusses. Steel beams and steel columns are integral elements of the main and upper level structure located at the north end of the building.

The main floor structure is framed with 2x12 wood joists spaced at 12 inches on center and spanning a maximum of 16 feet. Floor joists span in an east-west direction and are bearing on the east and west foundation walls and on the continuous 13-inch stone masonry wall located at the center of the building. The floor joists supporting library stacks, at the south end of the building, are supported on additional 8 inch x 8 inch wood beams located such that joist spans are limited to approximately 8 feet. Wood cross - bridging is present at the mid-span location of the 16 ft. floor joist spans.

Floor construction at the main level is hardwood finish flooring over nominal 1 inch diagonal wood sheathing.

The upper and lower level floors are of conventionally framed wood joist and plywood sub-floor construction.

The roof over the main level is framed with parallel chord flat wood trusses spaced at 32''o.c. with 2x10 joists centered between the trusses. The roof trusses span in an east-west direction and are supported by the east and west brick masonry walls. The top chords of the trusses are 2x10, bottom chords are 2x6, and web members are (2) 1x6's. The truss top chords step down from the south exterior wall to the south edge of the upper (mezzanine) level and are then sloped from west to east to achieve a positive slope for drainage from the south exterior wall to the roof gutter located along the east edge of the roof above the upper level.

The floor and roof structure appear to be in good condition and performing as intended.

3.3 Envelope-Exterior Walls

The exterior walls are generally 12 inch thick, load-bearing, brick masonry walls extending from the top of the crawl space foundation walls to the top of the parapets above the roof structure. The wall thickness at the south exterior wall is 4 ft. thick at the east and west ends. The mid-section of the south wall contains two stone columns measuring approximately 24 inches in diameter and are supporting stone lintels above (Ref. photo #1). A stone cornice extends continuously from around the brick pilaster at the southwest corner of the building, along the length of the south exterior wall and along the east exterior wall to the brick pilaster located at the south edge of the east handicap entry.

The north and south exterior walls are secured laterally with two reinforcing tie rods which extend through the roof truss space and are placed at the approximate $^1/_3$ points of the length of the wall (Ref. photo #2).

The east and west exterior walls are secured laterally with three steel tie rods located beneath the stone cornice, near the south end of the building, which are tied together with steel plate straps at each end. Two additional steel tie rods are located farther north, beneath the stone cornice (Ref. photo #3 & 6).

The exterior walls are in fair condition with signs of early wear and distress as evidenced by the presence of the aforementioned horizontal steel tie rods and steel strap plates. The tie rods and strap plates appear to be effective in preventing any tendency forward outward rotation of the walls.

Further wear and distress in the exterior walls is evidenced by the separation of brick mortar joints, damaged brick and stone units, and significant loss of mortar from the stone cornice vertical mortar joints (Ref. photos #21, 22, 23, 24, & 25). The above described damage to the exterior walls is primarily attributed to foundation movement and freeze/thaw affects of surface moisture which have likely been ongoing throughout the life of the building.

Although the foundation movement is central to the cause of the brick, stone, and mortar damage it is not considered active to the extent that serious structural damage will result. However, ongoing cosmetic and superficial repairs to the interior and exterior finished surfaces can be expected.

All loose brick and stone elements should be re-set and damaged elements should be patched or replaced. All loose mortar should be removed and mortar joints re-pointed.

Respectfully submitted,

NICOL ASSOCIATES, INC.
Consulting Structural Engineers

Joseph C. Nicol, P.E.
President

Vern Seieroe Architect A.I.A.
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29 August 2003

Ken Bloom, Executive Director
Boulder Museum of Contemporary Art
1750 Thirteenth Street
Boulder, Colorado 80302

Re: existing structure
Facility Master Plan, Boulder Museum of Contemporary Art

Ken,

Joe Nicol, structural engineer - Nicol Associates, Inc., and I have conducted several observations of the existing conditions of the building at 1750 Thirteenth Street. We have not been able to directly observe most repetitive member framing as it is concealed by gypsum dry wall sheathing. However, we are confident we have conducted a reasonable assessment of existing conditions though unique conditions may exist that are not aware of. Any construction work that exposes structure of the building should be used as an opportunity to further observe the existing conditions of the structure. I ask that I be notified when those opportunities are going to take place.

Our investigation has been limited to the west portion of the building, first and second level floor framing. We are of the opinion that it is reasonable to assume that the structure for the east portion of the building is sound as it exhibits clear evidence of remedial reinforcement of a contemporary construction material and technique. We also have not reviewed the roof structure of the west building as it has stood the test of time and appears to be in reasonably good condition. The existing masonry walls appear to be sound. It is common, in buildings of this construction technique and age, that the masonry walls are capable of carrying loads in excess of what is normal. Exceptions to that are when the building was constructed upon poor soils. These soils of this area are normally very useful for construction with exceptional stability and load capacity. The buildings condition appears to confirm that the soils here are consistent with that expectation.

The first level framing at the area of the existing elevator shaft appears to be over stressed for the type of occupancy of this portion of the building. In favor of this existing condition is the fact the walls that surround the elevator drastically prevent the usefulness of this area and therefore it is unlikely that the loading for which the code prescribes its structural occupancy load limitations would ever be met. Nevertheless, this condition exists and it is advised that, in the interest with both good structural code compliance and responsible maintenance of the building that this condition be remedied. It does not require an expensive or disruptive activity to accomplish the scope of work recommended.

The second floor is substantially under capacity for exhibit or other uncontrolled activity where a dense grouping of people could accumulate. As the second floor of the west portion of the existing building is currently used, for performance preparation and production, the very center structural bays in this area are under capacity per the requirements of the building codes. It should be noted, that the capacity of the existing structure does not allow for the use of this space as exhibition space for which it is intended to be used due to the limitations of the building codes. But in fact, this space has not been used for exhibition for over ten years. A future change to an exhibition type of use of the space would necessitate structural upgrade. Until this remedy is executed, it is recommended that the center structural bays be reinforced. It is important that no activity be permitted that would accumulate a large group of people, whether visitors, actors, or technicians, in the area. The remedy for this condition is to remove the ceiling below, install new joists beside the existing floor joists, and replace the ceiling. Such activity would be disruptive. It could be done during times the space is not occupied by the public. The gypsum demolition and reinstallation will produce extensive dust. Additionally, long joists will be brought in and installed. It is recommended that the actual work be done at a time that the space is not being used to display any objects of value.

This analysis is not intended to be through. At the time of an extensive renovation, such a through survey and analysis of existing conditions should be conducted. The recommendations presented are based upon the existing utilization of the space. Simply because the space has been provided to the Boulder Museum of Contemporary Art for exhibition of art, it is not necessarily adequate for that purpose, in particular the use of the second level as exhibition space.

Sincerely,

Vern Seieroe architect, A.I.A.
copy: file

Nicol Associates, Inc.
Consulting Structural Engineers

August 28, 2003

Vern Seieroe Architects
1936 14th Street
Boulder, Colorado 80302

Re: Boulder Museum of Contemporary Art
1750 13th Street
Boulder, Colorado 80302
Job No. 03215

Dear Vern:

In response to your request I met with you at the above referenced site on August 22, 2003 for the purpose of evaluating the existing original building structure, specifically, the first and the second floor and their capacities to support certain assembly area loads, including seating areas, performing arts areas and art exhibit areas as are intended and anticipated for the current and future use of the first and second floor. The "original structure" is defined as that portion of the existing building that extends east, approximately 60'-1", from the west face of the west exterior wall.

For design purposes, the second floor performance seating areas are considered "fixed" seating with live load requirements of 50 pounds per square foot. The performance/exhibit areas are considered to have a live load requirement of 100 pounds per square foot.

It is my opinion that, with the exception of the existing floor joists located directly beneath the performance/exhibit area at the center of the assembly area, the second floor structure, including floor decking, joists, beams, and interior columns, will safely support the anticipated seating assembly loads. In the event that these areas would be converted to exhibit areas, they should be reinforced to safely support those future loads.

To meet the second floor live load requirements of the performance/exhibit areas, it is my recommendation that each existing 2x10 floor joist located directly beneath the performance/exhibit area be reinforced with a "sister" 2x10 joist, spanning the full length of the joists. Furthermore, the combined existing/sister floor joist connections to the supporting beams should be reinforced with a pair of Simpson L50 reinforcing angles at each end of each combined joist. The reinforcing angles should be located in the space above the existing 2x4 ledgers. The existing ledgers should be checked for a minimum of (6) 16d nails for each single floor joist, and (4) 16d nails for each existing/sister floor joist combination. Refer to the attached detail 1/SD1.

For design purposes, the first floor will generally be considered art exhibit space with certain areas designated as lobby/reception areas. Live load considerations for such use is 100 pounds per square foot.

2770 Dagny Way, Suite 202
Lafayette, Colorado 80026

Phone: (303) 665-0090
Fax: (303) 665-1211

It is my opinion that, with the exception of the interior east end beam span (12'-2" span) of the original structure and all floor joist connections to the interior beams. the existing first floor structure of the original building will safely support the above described anticipated loads.

Regarding the two "east end beams" supporting the first floor, it is my recommendation that the spans of the beams be reduced by adding 8x8 wood posts beneath the beams at near their mid-span. Refer to the attached detail 1/SD2. The first floor joist to beam connection capacities can be sufficiently increased by adding one pair of Simpson L70 reinforcing angles to the ends of each floor joist. The reinforcing angles should be located in the space above the existing 2x4 ledgers. The ledgers should be checked for a minimum of (4) 16d nails for each floor joist. Refer to the attached detail 2/SD1.

This completes my initial evaluation of the first and second floor load capacities. Thank you for the opportunity to be of service. If you have any questions please call me at (303) 665-0090.

Sincerely,

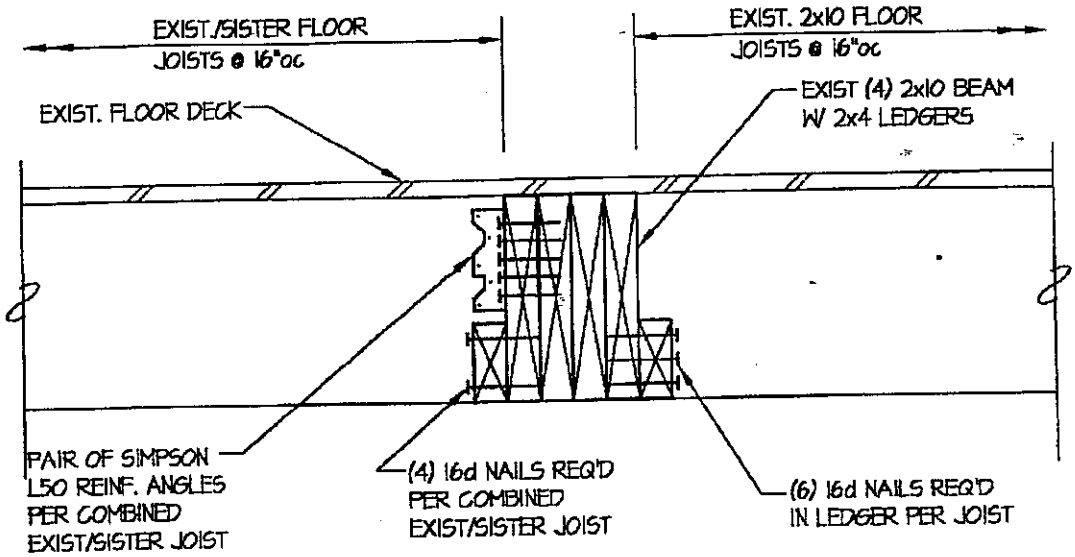
NICOL ASSOCIATES, INC.
Consulting Structural Engineers

Joseph C. Nicol, P.E.
President

attachments: SD1 & SD2

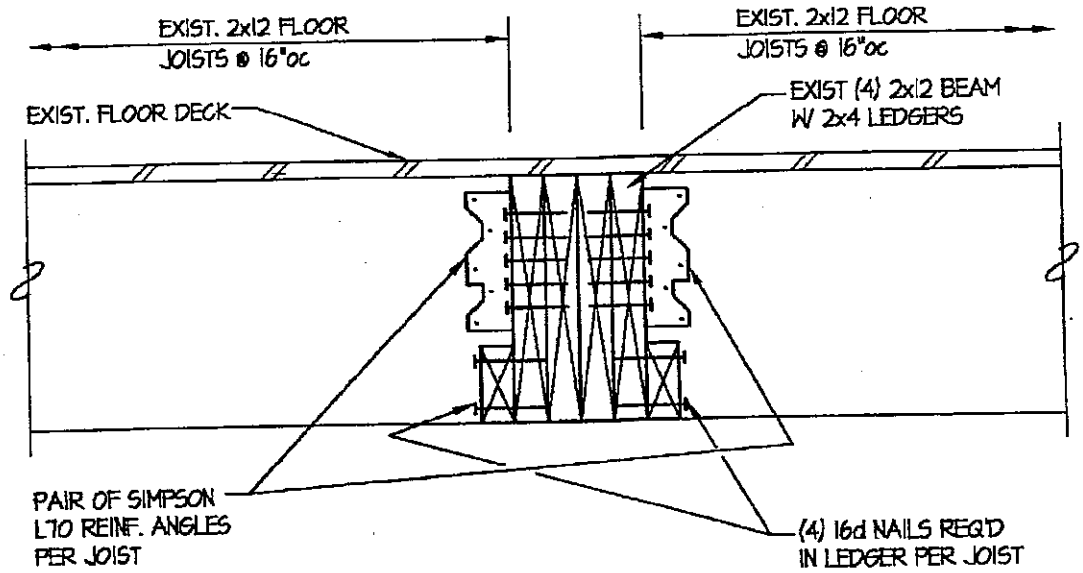
COLORADO REGISTERED
JOSEPH C. NICOL
11499
8/28/03
PROFESSIONAL ENGINEER

fl03215rpl



1 / SD1 SECTION

1 1/2" = 1'-0



2 / SD1 SECTION

1 1/2" = 1'-0

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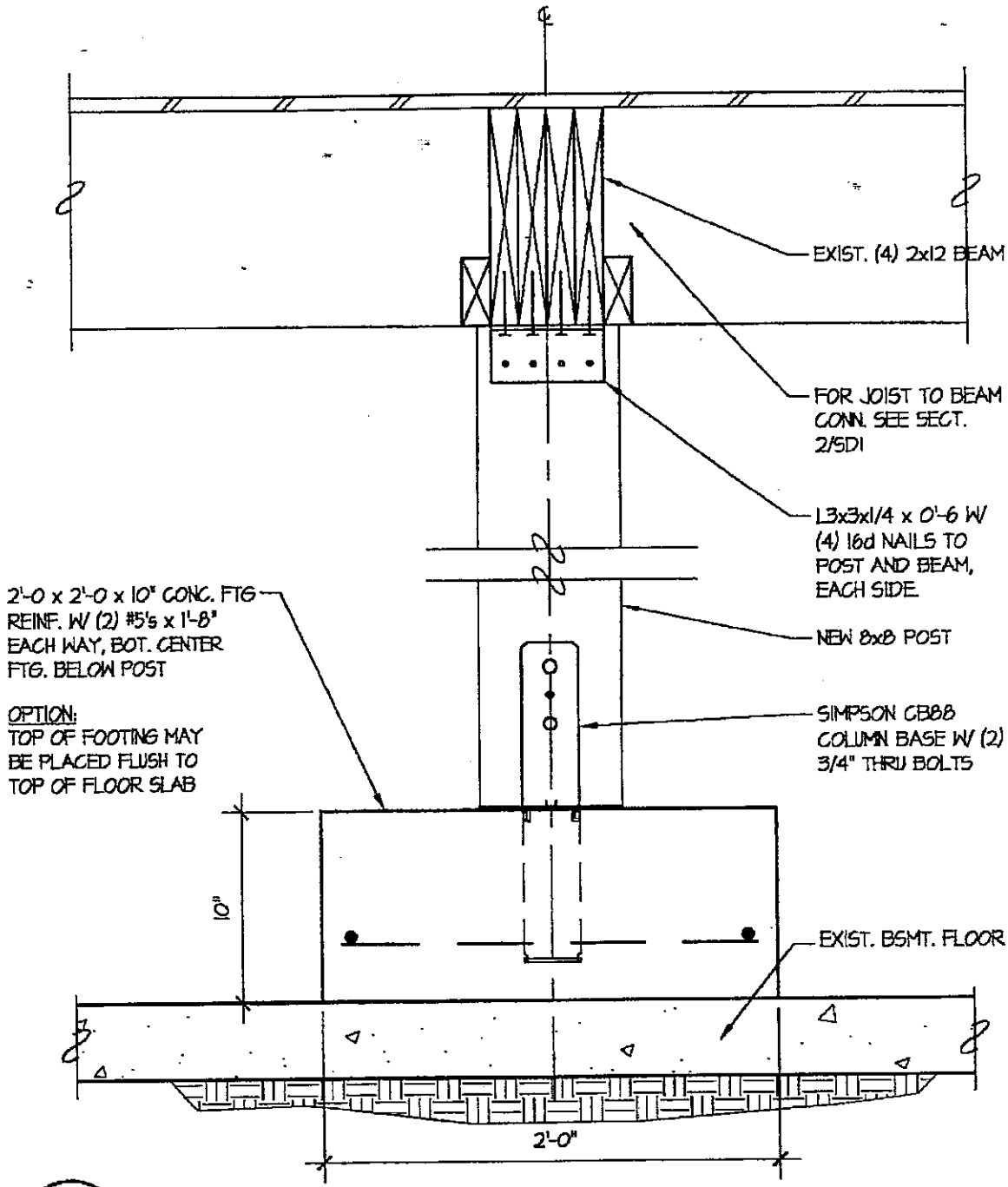
Project BMCA	Date 8/26/03
Client VERN SEIEROE	Sheet SD1
Job No. 03215	
Drawn By JCN	



1
SD2

SECTION (TWO LOCATIONS)

1 1/2" = 1'-0

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Project BMCA	Date 8/26/03
Client VERN SEIEROE	Sheet SD2
Job No. 03215	
Drawn By JCN	

Nicol Associates, Inc.
Consulting Structural Engineers

August 25, 2004

City of Boulder, FAM
P.O. Box 791
Boulder, CO 80306

Attention: Glenn Magee, Project Administrator

Re: Park Central Office Building
Job No. 04208

Introduction

This report is written to address, in general terms, three major concerns regarding the safety and protection of the Park Central Office Building and it's contents from possible outside destructive elements:

1. Damage resulting from explosive devices.
2. Damage resulting from run-away vehicles (either intentional or unintentional).
3. Damage resulting from Boulder Creek flood waters.

Building Description

The Park Central Office Building is a four story, reinforced concrete structure. There is open parking on concrete slab-on-grade at the ground level with 8" x 24", conventionally reinforced perimeter grade beams. The upper three levels and roof structure are 8" thick, post-tensioned concrete slabs with 16" wide x 24" deep (total depth) post-tensioned concrete spandrel beams at the perimeters. Each of the upper levels contain a gross floor area of approximately 6,742 sq. ft. Elevator, stair, and restroom facilities are enclosed with 9" thick conventionally reinforced tower walls and floors, located at the south-east and south-west corners of the building. Perimeter corner columns of the main structure are 16" x 16" conventionally reinforced concrete columns. Intermediate perimeter columns are 14" x 16" conventionally reinforced concrete columns. Three interior columns are 14" x 24" conventionally reinforced columns at the parking level.

The interior columns reduce to 14" x 20" columns above the parking level. The building is founded on reinforced concrete spread footings , placed at a minimum depth below grade of five feet.

A conventionally reinforced concrete canopy extends out from the east end of the main building to form a covered entry. The roof of the canopy is an 8" thick, conventionally reinforced concrete slab with a 36" wide x 24" deep post-tensioned spandrel beam at the east edge and a 14" x 24" post-tensioned spandrel beam at the north edge. The west edge of the canopy is supported by the main building structure while the south edge of the canopy rests on an existing on-story CMU structure. The north-east corner of the canopy is supported by a 14" x 16" conventionally reinforced concrete column and spread footing.

Damage Resulting From Explosive Devices

This building, as are most public buildings, is particularly susceptible to significant structural damage from explosive devices. Because terrorist attacks in this country are a relatively new concept, structural design engineers have not been inclined to consider such forces in the past and building codes do not normally address such activities in the conventional design of buildings.

Damage to this building structure would depend on the magnitude and placement of the explosive device(s) and may vary from minor, superficial damage to catastrophic collapse of the structure. Because of the post-tensioned systems within the floor structure of this building, isolated exposure to explosives, especially at the perimeter of the upper levels, would likely affect the structural integrity of the entire floor.

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Appendix (8C)

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City of Boulder, FAM
Attention: Glenn Magee
Project Administrator
Re: Park Central Office Building
August 25, 2004
Page 2

It is my opinion that the most cost effective protection against explosive devices is increased outside security. This may be accomplished in a variety of ways including barriers that would limit vehicle access to the building and fencing around the perimeter that would limit unauthorized foot traffic to areas underneath the building.

Damage Resulting From Run-Away Vehicles

Our study indicates that this building is susceptible to varying degrees of damage due to impact from run-away or out-of-control vehicles. Perimeter columns facing Broadway and Arapahoe streets can be expected to bare the brunt of the force of a vehicle impact. Passenger cars, small pickups and small SUV's weighing in the neighborhood of 2,500 to 3,500 pounds, traveling at a speed of less than 20 miles per hour, are not likely to cause significant damage to the building. However, if the speed is significantly greater than 20 miles per hour, damage could be enough to require replacement of the damaged column. Larger vehicles, e.g., cement trucks, tractor trailers, construction equipment, etc. are likely to cause significant damage to the building at any speed. The loss of one perimeter column from impact may not be catastrophic, but if two or more columns are destroyed, there would likely be at least partial collapse of the building and significant, irreparable damage to the surrounding structure.

In my opinion the best and most cost effective protection against run-away vehicles would be concrete barriers placed along the sides of the building facing the two streets.

Damage Resulting From Boulder Creek Flood Waters

My review of the construction documents indicates that the design engineer took in to account possible scouring and impact loads associated with flood conditions. I, therefore, have no reason to believe the building structure, as built, will not withstand the affects of the 100 year flood.

This completes my report. If I can be of further service in this matter, please let me know.

Sincerely,

NICOL ASSOCIATES, INC.
Consulting Structural Engineers

Joseph C. Nicol, P.E.
President

COLORADO REGISTERED PROFESSIONAL ENGINEER
JOSEPH C. NICOL
11499
8/24/04

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