



Planning & Development Department
Building & Safety Division

MEMORANDUM

TO: Eric Angstadt, Director, Planning and Development Department
FROM: Alex Roshal, Manager of Building and Safety Division *AR*
DATE: June 23, 2015
SUBJECT: Staff Recommendation Related to Library Gardens Balcony Collapse at 2020 Kittredge Street

Mr. Angstadt:

The Building and Safety Division offers our deepest condolences to the families and friends of the young adults who lost their lives in the tragic event at 2020 Kittredge Street. We extend our prayers and wishes of quick recovery to those that were injured.

Building and Safety Division staff are committed to identifying all the factors involved in this tragedy, and to offering specific recommendations for steps which can help prevent such an event from happening again. The scope of this analysis is limited to the direct observations of the Building and Safety Division staff in the immediate aftermath of the balcony collapse. Forensic examination and laboratory tests are outside the scope of the review.

The purpose of this analysis is to identify potential contributing factors to this tragedy, so that the City of Berkeley can take proactive measures to prevent future such events through changes to its local codes. This memo: 1) summarizes staff's actions in response to the balcony collapse; 2) describes staff's on-site observations; 3) confirms the original review of the relevant construction documents approved by the City; and 4) makes recommendations to the City Council to adopt new and modified regulations as local amendments to its codes to enhance the safety of existing housing and future construction in Berkeley.

1. Summary of Incident and Initial Analysis

At approximately 12:30 am on June 16, 2015, there was a structural collapse of a cantilevered balcony at 2020 Kittredge Street, Unit 405. This 5-story building contains

176 residential units and received its Certificate of Occupancy from the City of Berkeley on January 12, 2007. Attachment 1 includes summary information about the building permit process and categorization of the structure.

In response to a Berkeley Police Department (PD) request for assistance, Alex Roshal, Building Official, and Steve Messinger, Senior Building Inspector, arrived at the site of the balcony collapse at approximately 2:30 am. Upon arrival, Building & Safety Staff (also referred to in this document as Inspectors) were directed to Sergeant P. Hong of the Berkeley PD. Sergeant P. Hong informed the inspectors that several people had died as the result of the balcony collapse and others were taken to the hospital. Sergeant P. Hong requested that the inspectors perform an immediate damage assessment.

The inspectors performed a visual exterior examination of the building envelope from the street in the immediate vicinity of the collapsed balcony, and were then escorted by a representative of Berkeley PD to Unit 405 to inspect the immediate area of collapse. The Berkeley PD was on scene in Unit 405 and had not released the unit to the tenant. The inspectors observed from the exterior French doors of Unit 405 that the cantilevered balcony joists had completely sheared off approximately 16 – 20 inches from the exterior building face. A torn bituthene membrane hung over the joist ends.

The inspectors observed that the deck joist ends protruding from the exterior wall appeared to be severely dry rotted.

The inspectors were then escorted by a representative of Berkeley PD to Unit 305 located directly below Unit 405 to further observe the damage and to examine the condition of the collapsed balcony. The inspectors observed that the collapsed balcony hinged 90 degrees downward and rested against the building supported by the lower Unit 305 balcony guardrail. Some of the bituthene membrane was still connected to the remaining structure above. The guardrail from the collapsed balcony was detached. It had flipped 180 degrees, landing on the lower Unit 305 balcony guardrail. The stucco soffit underside of Unit 405's balcony was intact, hanging over the exterior French doors of Unit 305. This prevented the inspectors from opening the doors, but they were able to view the protruding floor joist ends above through a narrow space between the hanging stucco plane and the top of the French doors. They were also able to get a closer look at the apparently dry rotted debris scattered on Unit 305's balcony. The inspectors placed caution tape across the balcony doorway and affixed a red placard prohibiting any access to the balcony of Unit 305.

The inspectors then proceeded downstairs to meet with the property management company Greystar's representatives. The inspectors' immediate concern was that other weather-exposed balconies in the building could also be structurally compromised, and they inquired as to the location of any other cantilevered balconies in the building. Greystar's property manager, Natasha Moses, informed the inspectors that two more balconies existed in Units 202 and 144 (subsequently corrected to 244). The inspectors

were then escorted to Units 202 and 244, where they requested and were permitted entry by the tenants. The inspectors examined the balconies from the exterior doorways. No signs of distress were observed. However, since the condition of the balcony framing could not be verified at that time, the inspectors placed caution tape across the balcony doorways and affixed red placards prohibiting any access to the balconies until a follow-up structural evaluation could be performed. The inspectors then returned to the property management office and issued a Notice of Violation requiring the building owner to:

1. Immediately remove the debris of Unit 405's balcony from Unit 305's balcony.
2. Install a barricade at the balcony doorway of Unit 405.
3. Provide a structural evaluation of Unit 305's balcony within 48 hours.
4. Provide a structural evaluation of the balconies in Units 202 and 144 (subsequently corrected to 244) within 48 hours.

The inspectors left the scene at 6:30 am and by 8:00 am debriefed the City Manager's Office of the results of their initial review.

A. Field Analysis June 16th

On June 16, 2015, Alex Roshal, Building Official, and Patrick Emmons, Supervising Building Inspector, were present on the site throughout the day continuing with their damage assessment and assessing whether additional safety precautions were needed.

City staff stayed in direct contact with: (A) Greystar (the property manager), (B) BlackRock (the owner), (C) Belfor Property Restoration, who was contracted by the owner to perform balcony removal, (D) Josh Reynolds, S.E. (Structural Engineer) w/ Miyamoto International Inc., who was contracted by the owner to perform a structural assessment, and (E) Owen Rosenboom, PhD, S.E. w/ WJE Engineers Architects Material Scientists.

Building and Safety staff issued a revised Notice of Violation informing the property owner that all the debris from the collapsed balcony were to be removed and to be made available to City staff to transport to the storage facility at the City Corporation Yard. Prior to the removal of the balcony, the Supervising Building Inspector and a Berkeley Police photographer were hoisted in a platform lift to closely observe and photograph the conditions at the collapsed Unit 405 balcony.

From this location, the Supervising Building Inspector observed that the joist ends protruding from the exterior wall appeared to be extensively rotted at the failure points.

Towards the end of the day, the Unit 405 balcony was removed by Belfor, under the direct observation of Building and Safety staff, in a two-piece lift and loaded onto a City Public Works truck with a flat bed trailer. Public Works crews collected the remaining

debris from the public right-of-way. The Unit 405 balcony and the collected debris were then transported to the City Corporation Yard for secure storage.

Immediately following the removal of the Unit 405 balcony, the Unit 305 balcony was temporarily hoisted by crane to provide an additional vertical support. A Belfor crew cut exploratory openings on the underside of the balcony. Upon further review it was determined that the framing members supporting Unit 305 balcony appeared to be dry rotted at the exposed locations potentially presenting a danger of structural failure. Upon further consultation with the engineers present on the site, Josh Reynolds, S.E. and Owen Rosenboom, PhD, S.E., the Building and Safety Division issued a second amended Notice of Violation declaring the Unit 305 balcony unsafe and a collapse hazard endangering public safety, and ordering the following corrective measures:

1. Within 24 hours, remove the Unit 305 balcony to the extent necessary to remedy the immediate hazard.
2. Immediately board the door openings from Unit 305 to the exterior balcony and board all exterior openings directly below the Unit 305 balcony.
3. Apply for and obtain the necessary permits to perform all work required to restore the building envelope within the time frame listed in the notice.

B. Field Analysis June 17th

On June 17, Alex Roshal, Building Official, and Patrick Emmons, Supervising Building Inspector, were present on the site throughout the day. Around 9:00 am, the Belfor crew started disassembling and dissecting the Unit 305 balcony. The Supervising Building Inspector requested and was provided access via a man lift for an up close visual observation of the partially deconstructed Unit 305 balcony. The Supervising Building Inspector observed an approximately one foot wide open segment exposing the assembly layers. The Supervising Building Inspector observed what appeared to be two layers of oriented strand board (OSB) decking over the floor joists, a water proof membrane over the decking, and a base sheet material covered by approximately 2 inches of concrete. The Supervising Building Inspector also observed significant rot and decay to the outer support joist that seemed to decrease on the supporting joists towards the center of the balcony. Over the course of the day, numerous investigators inspected, measured and photographed the conditions at the Unit 305 balcony. By 7:30 pm, the Unit 305 balcony was removed and taken by Belfor Construction to their offsite secure storage facility. Upon removal of the two unsafe balconies in Units 405 and 305, the Building Official allowed the removal of the boarding protecting openings directly below the removed Unit 305 balcony.

C. Additional Follow-Up June 18th

On June 18th at 9:53 am, Blackrock Managing Directors Todd Slattery and Daniel MacEachron delivered the Structural Observation Report to the Building & Safety Division assessing the conditions of the two remaining balconies of Units 202 and 244. The report indicated that these balconies did not use the cantilevered framing

systems. Three access holes were cut into the gypsum board ceiling on the underside of each balcony for inspection. According to the structural observation report no signs of distress or water damage were observed at the Units 202 and 244 balconies.

In conclusion, based on the inspections and observations of the City of Berkeley's Building and Safety Division staff, the deck joist ends protruding from the exterior wall at Unit 405 appear to be severely dry rotted. Having completed this analysis, all materials which had been retained by the City are being released back to the property owner.

2. Code Analysis of Balcony Details as Shown on the Approved Plans

The following is the analysis from Building and Safety Division staff of the permitted Architectural and Structural Plans and Calculations related to the balcony construction at 2020 Kittredge (hereafter, collectively referred to as "Approved Plans"). This staff analysis assesses the Approved Plans' adherence to the 1998 California Building Code (CBC) which was in effect at the time of application submittal. Staff cannot make copies of these plans for others to review, per the prohibition on copying without the written permission of the architects and engineers who prepared them (California Health and Safety Code Section 19851). However, the approved plans are available for review in Planning Administration Office at 2120 Milvia Street, 3rd floor.

Balcony Construction

The balcony was designed using a 2-inch thick concrete topping slab installed over 1/8-inch asphaltic hardboard over a bituthene membrane underlayment over a primer as shown in Detail 12 on Sheet AD33 of the Approved Plans. Structural support was provided by two (2) layers of 3/4-inch tongue and groove oriented strand board (OSB) sheathing installed on 1³/₄x11⁷/₈ inches laminated veneer lumber (LVL) joists which were notched down to 9¹/₄ inches at the transition to the exterior and then sloped to a minimum depth of 7¹/₄ inches at the joist ends as indicated in Detail 12 on Sheet AD33 and Unit B8 3rd/₄th Floor Framing Plan on Sheet S1.6 of the Approved Plans. The Joist Legend on Sheet S1.6 of the Approved Plans specified that the perimeter framing of the balcony was to be formed by doubled up framing members. The bottom of the balcony was to be finished with metal lath and 5/8-inch minimum thickness cement plaster as required by 1998 CBC Table 7C Item #13-1.2 and as referenced in Detail 5 on Sheet AD22 of the Approved Plans.

Structural Design

Pursuant to 1998 CBC Section 1607.3.1 and Table 16-A, exterior balconies serving residential dwelling units were required to be designed using a live load of 60 pounds per square foot minimum. The design dead load varies for each application depending on the construction materials. A determination of the 45 pounds per square foot dead load was provided on Page a-3 of the structural calculations based on the floor assembly specified in Detail 12 on Sheet AD33 and Details 4 and 5 on Sheet AD22 of the Approved Plans. The calculations supporting the design of the balcony framing can be found on Pages a-42 and a-43 of the structural calculations. The load analysis

conservatively used the least dimension of the framing member at the cantilever and back span. The maximum stress ratio was determined to be 0.299, with bending stress controlling the design.

Fire Resistive Construction

Pursuant to 1998 CBC Section 310.2.2, multi-family residential structures more than two stories in height were required to be of not less than one-hour fire-resistive construction throughout, including projections. In order to achieve the required fire rating, an assembly conforming to 1998 CBC Table 7C Item #13-1.2 was specified in Detail 12 on Sheet AD33 and Detail 5 on Sheet AD22 of the Approved Plans.

Flashing

Pursuant to 1998 CBC Section 1402.2, openings in the exterior walls exposed to weather were required to be flashed in such a manner as to make the opening weatherproof. The flashing requirements applicable to the French doors leading to the balcony were specified in Detail 12 on Sheet AD33, Detail 3 on Sheet AD50 and Detail 10 on Sheet AD81 of the Approved Plans.

Weather Exposed Surfaces

Pursuant to 1998 CBC Section 1402.3, balconies exposed to weather and sealed underneath were required to be waterproofed and sloped a minimum of ¼ unit vertical in 12 units horizontal (2 percent slope) for drainage. Detail 12 on Sheet AD33 and the Unit B8 3rd/4th Floor Framing Plan on Sheet S1.6 of the Approved Plans specify the required slope satisfying drainage requirements.

Pursuant to 1998 CBC Section 2306.9, wood structural members supporting moisture-permeable floors that are exposed to the weather, such as concrete, were required to have natural resistance to decay or be treated wood unless separated from such floors by an impervious moisture barrier. Bituthene membrane over primer was specified in Detail 12 on Sheet AD33 of the Approved Plans.

Moisture Content

Pursuant to the 1997 Edition of National Design Standard for Wood Construction (NDS) Section 2.3.3, a moisture content of 19 percent is recognized as an appropriate upper limit for a dry condition of service for lumber used in wood structures. This requirement is reflected in Carpentry Note #14 on Sheet S0.1 of the Approved Plans. However, as the balcony structure utilized an engineered wood product, it was subject to the more restrictive limitations established under International Code Council (ICC) Evaluation Report ER-4979 (issued April 1st 2002) Section 4.3, which required the end-use average equilibrium moisture content of the structural composite lumber to be equal to or less than 16 percent.

Ventilation

Pursuant to 1998 CBC Section 1505.3 and 2306.7, ventilation is required for enclosed spaces at attics and under-floor spaces between the bottom of the floor joists and the earth under the building. Ventilation of other concealed spaces was not required.

Code Mandated Inspections per 1998 CBC Section 108.5

The following are the CBC sections mandating inspection (*italics in original*):

108.5 Required Inspections.

108.5.1 General. Reinforcing steel or structural framework of any part of any building or structure shall not be covered or concealed without first obtaining the approval of the building official.

Protection of joints and penetrations in fire-resistive assemblies shall not be concealed from view until inspected and approved.

The *[for HCD 1] enforcing agency*, upon notification, shall make the inspections set forth in the following sections.

108.5.2 Foundation inspection. *[For HCD 1] Inspection should be made after excavations for footings is complete and any required reinforcing steel is in place. For concrete foundations, any required forms shall be in place prior to inspection. All materials for the foundation shall be on the job site; however, where concrete is ready mixed in accordance with approved nationally recognized standards, the concrete need not be on the job site. Where the foundation is to be constructed of approved treated wood, additional inspections may be required by the building official.*

108.5.3 Concrete slab or under-floor inspection. *[For HCD 1] Inspection should be made after all in-slab or under-floor building service equipment, conduit, piping accessories and other ancillary equipment items are installed, but before any concrete is placed or floor sheathing installed, including the subfloor.*

108.5.4 Frame inspection. *{For HCD 1] Inspection should be made after the roof, all framing, fire blocking and bracing are in place and all conduits, plumbing pipes, chimneys and vents are complete and the rough electrical, plumbing, and heating wires, conduit, plumbing pipes and ducts are approved.*

108.5.5 Lath or gypsum board inspection. *[For HCD 1] Inspection should be made after all lathing and gypsum board, interior and exterior, are in place, but before any plastering is applied or before gypsum board joints and fasteners are taped and finished.*

108.5.6 Final inspection. *[For HCD 1] Inspection should be made after finish grading and the building is completed and ready for occupancy.*

In summary, Building and Safety Division staff confirms that the Approved Plans complied with the applicable CBC requirements in effect at that time, and also that all CBC-mandated inspections were conducted.

Staff Recommendation To Adopt Local Amendments To CBC And The Berkeley Housing Code (BMC Chapter 19.40)

In order to reduce the possibility of the formation of dry rot or other moisture-related damage in future new construction, and to help ensure the safety of existing residential housing structures, the Building and Safety Division recommends emergency adoption of the following code amendments based on local climatic conditions. These amendments would increase the ventilation requirements and impose material restrictions for newly constructed balconies and similar space exposed to weather and sealed underneath, as well as institute maintenance inspections on a regular schedule post-construction.

BMC Chapter 19.28 Berkeley Building Code:

- Add Section 1203.6 to read as follows:
Section 1203.6 Ventilation of weather exposed enclosed assemblies. Balconies, landings, decks, stairs and similar spaces exposed to the weather and sealed underneath shall have cross ventilation for each separate space by containing ventilation openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. The net free ventilating area shall not be less than 1/150th of the area of the space ventilated. Ventilation openings shall comply with Section 1203.2.1. An access panel of sufficient size shall be provided on the underside of the enclosed space to allow for periodic inspection.
Exception: An access panel is not required where the ceilings applied directly to the underside of joists are easily removable using only common tools.
- Add Section 1404.13 to read as follows
Section 1404.13 Projections exposed to weather. Balconies, landings, decks, stairs and similar floor projections exposed to the weather and sealed underneath shall be constructed of naturally durable wood, preservative-treated wood, corrosion resistant (e.g., galvanized) steel, or similar approved materials.
- Amend Section 2304.11.4.2 as follows:
Section 2304.11.4.2 Wood structural members. Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or preservative-treated wood ~~unless separated from such floors or roofs by an impervious moisture barrier.~~

- Amend Section 2304.11.5 as follows:
Section 2304.11.1 Supporting members for permanent appurtenances. Naturally durable or preservative-treated wood shall be utilized for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances where such members are exposed to the weather ~~without adequate protection from a roof, eave, overhang or other covering to prevent moisture or water accumulation on the surface or at joints between members.~~

BMC Chapter 19.40 Berkeley Housing Code:

- Add Section 601.4 to read as follows
Section 601.4 Structural Maintenance. All exterior elevated wood and metal decks, balconies, landings, stairway systems, guardrails, handrails, or any parts thereof in weather-exposed areas of Group R-1 and R-2 Occupancies, as defined in the Building Code, shall be inspected within six months of adoption of this section, and every five years thereafter, by a licensed general contractor, or a structural pest control licensee, or a licensed architect, or a licensed engineer, verifying that the elements are in general safe condition, in adequate working order, and free from hazardous dry rot, fungus, deterioration, decay, or improper alteration. Property owners shall provide proof of compliance with this section by submitting an affidavit form provided by the Housing Code Enforcement Office. The affidavit shall be signed by the responsible inspecting party and submitted to the Housing Code Enforcement Office.

Staff from the Berkeley Building and Safety Division believe that immediate adoption of the recommendations within this memo will be a step towards improving the safety of Berkeley residents in both existing buildings and those which will be built in the future.

cc: Christine Daniel, City Manager
Dee Williams-Ridley, Deputy City Manager
Zach Cowan, City Attorney

Eric Angstadt, Director

June 23, 2015

Page 10 Re: Staff Recommendation Related to Library Gardens – 2020 Kittredge St.

Attachment 1: Building Summary

Applicable Code: 1998 California Building Code

Building Permit No 02-858

Date of Application: 03/05/2002

Date of Issuance: 11/15/2004

Date of Final Inspection: 01/04/2007

Date of Certificate of Occupancy: 01/12/2007

Occupancy/Use: Group R Division 1 Apartment House

No. of Residential Units: 176

Type of Construction: V 1-HR over I-F.R.

Stories: 5

Sprinkler System: Yes