

Memorandum

To: Rod Gould, City Manager
From: Ron Takiguchi, Building Officer, PCD
Date: 09/06/2012
Re: Assessment of Chain Reaction Sculpture



The attached Chain Reaction sculpture report by the structural engineering consultant Mr. Melvyn Green contains recommendations for its preservation as an art work and recommendations for its repair to extend the life of the sculpture. The report also contains analyses of the sculpture in its current condition and analyses at a projected ten-year mark. This memo references the consultant's analysis and provides my official recommendation for protection of public safety as the City's Building Officer.

Following the consultant's review of the basic calculations, test data, and reports, the consultant stated "that the sculpture is not an imminent hazard nor should it be considered dangerous." Additionally, he stated that "We analyzed the structure under current building code loads and found that it remains compliant with current standards." However, throughout the report, the consultant provides statements regarding unknown and indeterminate factors of the structural safety of the sculpture. These include concerns for welds in the mushroom dome, deterioration of the fiberglass and its load capabilities, rust treatment and prevention, and repair for longevity considerations.

The primary unknown element of the sculpture is a major structural connection found within the mushroom dome of the sculpture. This connection is identified in the consultant's report as Figure 1 and shows welded connections to the major steel framing of the dome. This connection is critical due to the dependence of the dome's weight, wind and seismic resistance on this connection. Since the last phase of forensic testing could not adequately access this connection, the integrity of this critical connection remains unknown. Full safety determination of this connection will require access to this connection.

The factor that is indeterminate is the level of safety affecting the fiberglass covering, particularly at the dome of the sculpture in which the report states that "the flexibility, or brittleness, showed a significant loss due to ultra-violet." The report states that "flexural strength is not significant", but adds "However the loss of flexural strength indicates a deterioration of the fiberglass." The report goes on to say that "the concern would be that the rate of deterioration of the fiberglass will accelerate and will eventually lead to a failure. Failure could be tearing or cracking under its self weight as well as wind or earthquake loads."

The following are my recommendations based on the consultant's analysis and findings of the sculpture's current condition and at a projected ten-year mark.

Recommended measures to address immediate safety needs

Considering the consultants statement that the screw fasteners holding the copper chain links "appears adequate but there needs limited access to prevent climbing.", I recommend a barrier be placed around the sculpture to prevent public access to the sculpture. Further, given the unknown

factors of critical welds in the dome, and the indeterminate level or rate of degradation of the dome's fiberglass, this barrier should be a minimum dimension equal to one-half the height of the sculpture to act as a protective barrier should failure of any part of the sculpture occur. For example, a circular barrier encompassing the sculpture should have a minimum radius of 13-feet - one-half of the 26-foot height of the sculpture - from the outer edge of the sculpture's base. The determination of this distance is based on pedestrian protection found in Chapter 33 of the California Building Code for Safeguards During Construction.

While a protective barrier around the sculpture will prevent people from easily accessing the work, it will not address issues related to impacts from environmental conditions including but not limited to moisture, rain, ultra-violet rays, salt laden air, wind and seismic effects.

Ten-year projection while addressing immediate concerns

The consultant's report raises concerns at a projected ten-year mark should the fiberglass and interior structural steel remain unattended. Sharing concerns of the consultant, and with the presence of the unknown and indeterminate factors, I assert that in order to afford the safety of the public, the sculpture will require specific urgent repair and regular maintenance. To provide for public safety, the consultants "Recommended Repair To Extend Life" at the "Minimum Program" level should be implemented with the following added requirements:

- Immediate removal of the dome from its mounting stem to allow access, analysis, maintenance, repair and replacement of key elements.
- Immediate analysis of the welded plates and connections to determine their adequacy. The adequacy of these critical elements shall be confirmed with structural calculations.
- Maintenance of the steel structural members and steel top plate that exhibit mild or severe corrosion. Maintenance will be in the form of rust removal, treatment and coating. This action may be performed as regular maintenance but is suggested to take place while the dome is removed and the steel members are easily accessible.
- Immediate full replacement of the fiberglass covering of the dome. This includes the base lath mesh that exhibits rust on the lath wires.

Although the cost estimates in the March 20, 2012 Council Staff Report did not include considerations for removal and replacement of the dome's fiberglass, it is anticipated that the cost to make all of the outlined recommendations would place the cost toward the high-end estimate of approximately \$425,000 as indicated in the March 20th Staff Report. To provide a more defined estimate, and from an individual with direct familiarity of the sculpture, Cultural Affairs Manager Jessica Cusick has contacted Mr. Peter Carlson, the sculpture's original fabricator. Mr. Carlson stated that he thought the repair costs would approach the high-end estimate; however he has not yet submitted a written estimate. Further, Mr. Carlson's estimate may be revised upon incorporation of the costs for the dome's removal and required corrective actions.