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Regarding: Proposed Revisions to Elevator Safety Orders
Advisory Committee Meeting, December 18, 2012

Subject: Written Additional Comments

Dear Mr. Barker,

I am writing in follow-up to the DOSH Elevator Unit presentation and the public discussion for the proposed Revisions to Elevator Safety Orders, Advisory Committee Meeting held on December 18, 2012. This letter is in response to your request for written additional comments. I preface these by saying that it isn't always possible to fully explain the logic and intent of comments in written form. Therefore, I welcome an opportunity to discuss the following with you by meeting or telephone, should this be of assistance to you.

Firefighters' Emergency Operation

I have concluded it may be appropriate to differentiate between Low-Rise and High-Rise elevator installations, as defined by the CBC, with regard to Firefighters' Emergency Operation (FEO) testing. As an anecdote, I received a call yesterday from a church elder who was troubled by their diminishing coffers and paying their monthly elevator maintenance service bills of over $300. They have a single, two-stop hydraulic elevator infrequently used for accessibility and handling groceries, etc. Though they are billed monthly, they receive "periodic" service, which translates to actual visits by their major elevator company technician as infrequently as quarterly. If the proposed language is approved as written and if enforced, the maintenance providers would most likely have to escalate their maintenance contract prices to offset the cost of monthly site visits.

I believe in most cases with Low-Rise elevators, the FEO need not be tested monthly. Language could be written to make monthly testing a recommendation but not a requirement. Quarterly testing would be sufficient for these elevators. My reasoning includes:

a. It is important that FEO Phase I be operational so as to reduce the likelihood of passengers being trapped in an elevator in the event of a fire. However, as per my anecdote above, many Low-Rise elevators are of infrequent use. Their travel times are relatively short due to the short rises. Phase I operation would likely only be used via fire alarm initiating devices, rather than key operation. It is reasonable that building occupants would exit the building by means other than the elevator(s), as instructed by the signage.
b. As the SFFD representative has indicated, they as a matter of policy and practice do not use FEO Phase II operation on low-Rise buildings. Instead they use the stairs or their ladder trucks to access the various floors. Indeed, it is my understanding that the CBC designation of Low-Rise and High-Rise turns on the height limitations of firefighters' ladder trucks, which typically extend to approximately 75 feet.

c. The bulk of the technical complexity of FEO is in the Phase II logic and circuitry. If there is a fault or malfunction, it is more likely to be with Phase II operation. As stated above, Phase II is of less criticality than Phase I for Low-Rise structures, if even included in the system.
d. The cost for monthly testing by CCCM personnel would be prohibitive, in many cases.

Regarding High-Rise facilities, I believe that FEO should be tested monthly and that it should be conducted by a CCCM. My reasoning:

a. Due to the rises involved, evacuation of building occupants include use of the elevators, first via Phase I automatic recall and secondly via Phase II use by emergency personnel. Therefore, it is highly critical that these systems be fully operational.
b. Fire Departments use elevators to access landings above 75 feet to fight fires.
c. Due to the severe necessity for FEO to be operational, nothing short of monthly testing would be sufficient. I would argue that with ultra-high-rise (although I'm not sure to what height this would be defined), testing should probably be weekly. I would suggest that you consider this option, either in firm language or at least in recommendation.
d. On the question of whether it would be advisable to delegate the FEO tests (or "checks") to non-CCCM personnel, I believe there is ample evidence that where this is, in effect, now being done, it is too often not being done correctly. The complexity of Phase II operation is such that greater knowledge of applicable codes and of the actual equipment is needed than can be – or should be – expected of non-CCCM personnel. Any argument that such personnel will be sufficiently trained, advised or instructed to perform the testing/checking might be compelling, but I would contend unlikely to be accomplished in reality.
e. A point I raised at the meeting, an underlying issue in our industry has been what shall be the necessary frequency of elevator maintenance. Any regulation referencing a requirement for something to be performed onsite "monthly" would impact the industry more greatly than might otherwise be perceived. As I mentioned earlier, it is currently common practice that elevator maintenance not be performed monthly, even with some designated High-Rise facilities. I view of this effect, I would argue that the proposed, base language be adopted and enforced. This would help to ensure that FEO is fully operational and also effectively achieve a baseline minimum level of onsite service. Frankly, all High-Rise facility elevators require at minimum, monthly onsite service.

Going through the most recent ASME A17.1 Interpretations, Vol 3: Interpretations Approved from Sept 2009 through Jan 2012: http://cstools.asme.org/csconnect/CommitteePages.cfm?Committee=L01030800&Action=1462, I found one relating to this issue: Inquiry 11-55 (see copy enclosed). It specifically relates to A17.1-2004, Requirement 8.11.2.2.6 Elevator Personnel. The question states, "As part of a periodic test, should "elevator personnel" verify that the elevator responds correctly by activating the fire alarm initiating device inputs on the elevator controller?" The answer given by the Standards Committee dated January 26, 2011 is, "Yes." This formal Interpretation is interesting for two reasons, first is the specific reference to "elevator personnel" and the second is to the real intent of the question, what specifically is being tested. In this Interpretation, the testing method for Phase I is via, "activating the fire alarm initiating device inputs on the elevator controller." The proposed Draft Language for Elevator Safety Orders only requires testing FEO via the Phase I keyswitch. It is my understanding that with most elevator controllers, the circuitry may not be the same for the two inputs. Therefore, it's conceivable that checking only one input may not detect a flaw existing in the other. I would recommend the Division look into this point further to determine whether only keyswitch testing is sufficient.

Elevator Control and Machine Rooms

The proposed language would have far-reaching effects throughout the industry, including:

1. Requiring a dedicated motion control or machine room would require vast modifications to almost all of the “new technology” elevator systems being brought to the market or it would bar them outright if they couldn’t be modified. Most of the machine-room-less (MRL) elevators and some of the newest hydraulic elevators currently offered by the major elevator companies have their motion control systems located either within the hoistway overhead or in at least one case, actually in the entrance door frame. Some have simple access doors on a hoistway wall that are opened to access the equipment. Before adopting this language, I would recommend that a survey be performed of the major equipment providers as to the feasibility of relocating these control systems into dedicated, enclosed control rooms with the specified work clearances. My caution simply is that the Division must recognize the full effect of this action, so as to avoid any unintended consequences and so the adopted regulations can be sustained. Indeed, if it is the intent of the Division to bar hoistway or open-room/hallway elevator control access, then this language would accomplish this goal.

2. Your presentation of this item and the subsequent discussion at the meeting cited numerous examples where either cartop or open building access to motion control equipment may be hazardous to worker or public safety. Others testified that such systems pose no substantial hazards. I would separate the potential for hazards into two categories: Potential hazards to CCCMs where a certain assumption of risk is unavoidable due to the inherent nature of the work; and to the general public, who quite logically require a different standard. If in the final analysis something is deemed a sufficient hazard to warrant these new regulations, the Division must recognize the economic impact such regulations will impose on the public. An alternate approach to some of the issues might be to define some guidelines regarding protection. For example, language might be written to require that the path of egress not be blocked or indicate more clearly temporary barricade requirements.

3. A separate effect this language would have is to prevent the excessive distances between machine rooms and hoistways, as historically seen with hydraulic elevator installations. The decision as to where the hydraulic elevator machine room is located when a building is designed is typically made by the project architect and their team. Often this decision is based on architectural convenience, resulting is machine rooms remote from the hoistway by as much as 150 feet. In addition to the fire hazard to the remote electrical wiring, there are numerous other ill effects of this practice. Energy consumption rises as the length of the hydraulic line increases, as does heat generation. Remote piping is often located underground, which too often has resulted in hydrocarbon pollution due to oil leaks. These leaks can be caused by feedline corrosion, electrolysis, fractures due to slab settlement and seismic activity. I would also favor regulations banning the location of hydraulic feed lines underground or within the floor slab or foundation.

Regarding the signage requirements in the language, I believe the requirements are wise and reasonable.

<u>Suspension Means Standards</u>
I have little to offer by way of comments to this section. The outright ban on Aramid Fiber ropes is, I believe, warranted. Many in the industry content that we may not have seen the full effect of the use of alternate means of suspension as defined in A17.6-2010. Some contend that these new technology suspension means are prone to more rapid failure than the time-honored steel wire ropes. However, these new suspension means do provide for greater energy efficiencies and lower costs of installation and operation.

<u>Car Top Railings</u>

First, I have to comment that the proposed language corrects an error made in the last code adoption regarding alterations referencing section 8.4, with the added language, “that are applicable to the alteration.” This is something I made the Division aware of over 4 years ago. That technically a literal reading of the code would indicate that any Alteration, no matter how minor, would trigger the full and complete seismic retrofit of a seismic non-compliant elevator. For instance, installing new flooring in an elevator cab would require the reinforcement or replacement of the existing, deficient 8 lb/ft counterweight guiderails and more. I’m not aware that this error has ever before been addressed by the Division.

I’ll take this opportunity to say, however, that I believe there needs to be regulations written to address the gross structural and seismic deficiencies that I witness on almost a daily basis in my work, providing elevator design and engineering services (RCB Elevator Consulting, LLC). The CCR Title 8 code, retroactive seismic upgrade language added over three decades ago was too prescriptive in allowing non-engineered solutions, such as the blanket addition of undefined-strength tie brackets for rail bracket spans of greater than 10 feet. We can show abundant evidence of existing deficient, non-compliant installations where 1/8” stamped sheet metal slide clips were used, which will fail easily with the seismic loads, deficient thin-gauge bracketing with weak building connections, non-secured equipment that will shift and fail, non-existent or inadequate rope retainers, etc.

As I’ve discussed with the Principal Engineer, at minimum there should be a code trigger to at least *inform* a building owner of existing elevator structural and seismic deficiencies. I believe such a trigger could reasonably be an Alteration of a specified dollar value or major scope of work, such as a controller replacement. Again, rather than a mandate to correct the deficiencies, the trigger could simply require that the owner be *notified* of the deficiencies, so that the owner can then elect to make the corrections or possibly budget for the work at a later time. It’s now common for building owners to spend hundreds of thousands of dollars to modernize their aging elevator systems, similar sums for the car interiors alone, and not ever be aware that their elevators having potentially life-threatening structural and seismic deficiencies – no one tells them! I’ve argued this point for years with elevator consultants and elevator company representatives, and they typically retort, “If the code doesn’t require it, we’re not going to bring it up.” At the very least, the Division could release an Advisory to the public to have their older, pre-1998 elevators checked for seismic compliance. I’m certain that if building owners were aware of their elevator seismic deficiencies, a great number of them would take corrective action.

Back to Car Top Railings, there are a number of issues to understand and work out with this language. First, I think it’s important to point out that it’s apparent the Division as adding a completely new safeguard with respect to top-of-car elevator hoistway access. A17.1-2004 section 2.14.1.7 is intended solely as fall protection. The railing system is required when the car top to hoistway clearance exceeds 12 inches. The logic being it is unlikely that a person would fall through a gap of 12 inches or less. The Division’s proposed language is apparently designed to safeguard against injury from shearing or crushing as may occur between the car top guardrail and horizontal projecting or overhead objects that might be encountered when travelling in the hoistway. The Division sites examples where such injuries have occurred.

The first means of compliance would be to distance the railing from the hoistway or objects in the hoistway, including the counterweight, by a minimum 12 inches. For a counterweighted elevator, this would require the car-side face of the counterweight to be set away from the edge of the car a minimum 10 inches, with a 2 inch spacing of the outward face of the railings to the edge of the car. To my knowledge, there are no standard elevator systems sold with such a layout. To provide such a layout would require enlarging the hoistway and other elevator design modifications, including possibly increasing the vertical distance between machine drive and deflector sheaves to maintain the required

rope arch-of-contact for sufficient traction. Effectively, such dimensions would require non-standard, custom elevators.

The Division provides two alternate means of compliance, the first being full height screening of the objects. This would be the likely solution as it would be possible to fit the screening in the typical running clearance between the car and counterweight. However, the screening would have to be very well designed and installed so the current minimal clearance (typically 2 inches for seismic) does not present potential contact with the screening from the car or counterweight. Auxiliary brackets to the standard counterweight brackets could be utilized. I believe it would work.

The second alternate provided is to set back the guardrail system up to 12 inches on the cartop, so as to achieve the minimum 12 inches horizontal clearance to the hoistway or obstruction (counterweight or equipment). Actually, these dimensions would suggest an existing zero running clearance whereas a Group II elevator would have a minimum of 1 inch running clearance and a Group III or IV would have 2 inches clearance. Logically, the redundant language "but no greater than 305mm (12 inches) from the perimeter of the car top" could (and should) be removed. The statement preceding this wording effectively establishes the maximum setback of the railings and the result would necessarily be less than 12 inches. This alternate would only work in the rare situations of cars that are deep or wide enough so that the guardrail could be moved back onto the car top without either creating a space too small to functionally work or interfere with other systems or requirements, such as the emergency exit or the car ventilation, etc. But it would be a solution for many freight elevators and possibly many hospital or service shaped cars.

Regarding the signage for this second option, I encourage you to review the OSHA standards for the three common terms. They are: DANGER means if the danger is not avoided, it will cause death or serious injury. WARNING means if the warning is not heeded, it can cause death or serious injury. CAUTION means if the precaution is not taken, it may cause minor or moderate injury. The proposed language use of CAUTION would appear to be inappropriate in this situation. The presumed hazard of climbing over the railing would be falling off of the car top or getting pinned between the car top and the hoistway or object, all of which would most likely "cause death or serious injury." Therefore, it would seem that DANGER would be the correct admonition, or at the very least, WARNING. Another editorial comment is that when defining degrees, it is standard to indicate from which plane. Therefore, the phrase "75 degrees" should include the addition "from horizontal."

Another option to consider would be the use of electronic barrier safeguard systems. There are many that are readily available and adaptable for elevator car top protection. One in particular that I have sourced is the Omron Safety Laser Scanner model OS32C: http://www.sti.com/products/OS32C/index.htm. These programmable devices can be set to specified widths and heights and installed to create a protective light curtain along the vertical face of the guardrail, within the defined 2 inches between the railings and the edges of the car. This would likely prove much more economical to full height screening or a setback of the railings. Plus, such a system would enhance safety as it would not allow the car to move, or would stop the car when moving, on car top access if the infrared beams were broken. Simply a finger moving across this vertical light curtain would trigger a stop, eliminating any potential for physical contact with anything outside the protected perimeter. I encourage the Division to look at this option and draft language to include this as a third alternate.

Lastly, I mentioned at the meeting that my firm is currently engineering to manufacture and sell an automatic, power operated, vertical telescoping car top guardrail system. There are many existing elevator systems that lack sufficient overhead clearance to allow the installation of a fixed, stationary guardrail system as specified in A17.1-2004, section 2.14.1.7 and as indicted in the proposed

language. For new elevator installation, the MRL products are often used so as not to penetrate the roofline. Many of these also have insufficient overhead clearance for the railing system as well.

When I was initially approached to provide a telescoping car top guardrail system, the request was to design one that would be manually raised and lowered. I've rejected this idea as insufficiently safe in that a manual system might easily be circumvented and not raised when required. Simply switching a manual guardrail system against operating the car on car top access would not be satisfactory. A person could enter the car top without the intention of moving the car, but simply to perform some function with the car stationary. Doing so without the guardrail raised presents a fall hazard. Also, the act of manually raising or lowering the guardrail would likely require accessing the car top at the perimeter of the car, which in itself would present a fall hazard before the railing could be raised or after the railing has been lowered.

The only safe option would be to have the telescoping car top guardrail system be fully automatic. What we propose is electrically driven linear actuators to raise and lower the guardrail system, which would include the 42" top railing, 21" center railing and 4" kick guard, and would meet the strength requirements indicated. When the elevator is in Normal Operation, the guardrail system would be retracted to approximately 18 inches vertically above the car top. The system would be driven by the elevator controller or a controller subsystem and operated in conjunction with the Hoistway Access Operation (HAO). With the car station HOA switched to ON and the access key switch at the top landing turned to the DOWN position, the car would descend as normal. As the car descends, the guardrail would rise to its full raised position. A forced contact limit switch(es) would change state to indicate the railing is fully extended, only at which point the car top run station would become operative. An audible alarm and/or flashing warning light could be included should the system malfunction and the guardrail system fail to rise, warning the operator against accessing the car top. In such an occurrence, full fall protection gear could be donned to safely access the car top to make repairs to the guardrail system.

Reversing the process, after exiting the car top, the operator would turn the HAO key to the UP position, raising the car. Simultaneously, the guardrail system would automatically lower to its retracted position. A forced contact limit switch(es) would change state to indicate the guardrail is fully retracted, only then allowing the elevator to return to Normal Operation. In the event the elevator car top is accessed by means other than the HOA, such as by a Hoistway Door Unlocking Devices (not allowed in California per section 3141.7(a)(1)) or by door pick or stringing the pickup rollers, a dedicated and labeled secondary keyed operation switch will be provided at the front of the car top, operable to raise the guardrail system prior to accessing the car top. The previously mentioned safety limit switches would operate as indicated.

I would make the case that a fully automatic, retractable guardrail system can be installed in a failsafe fashion and at a reasonable cost. This would be a viable solution to existing (or new) hoistways with insufficient overhead clearance for a fixed-height guardrail and would provide the same level of fall protection. It can also be installed in conjunction with the aforementioned electronic safety curtain.

<u>Definitions Review (Supervision)</u>
I concur with what I took to be the consensus of the meeting discussion that the definition of the important term, "Supervision," rightly needs to be broken down into at least two categories. Another approach may be to look to using different terms, appropriate synonyms, to better define the intent. One category might be with respect to employees of a CQCC, the supervision of Apprentices and Helpers by a CCCM. In fact, Apprentices and Helpers may require different levels of supervision to ensure workplace safety.

The other category would be personnel not affiliated with a CQCC, such as workers of other trades. This is a very different aspect of the Labor Code insofar as defining that work that must be performed by CQCCs & CCCMs and that work that logically should not be performed by CQCCs & CCCMs but, due to the workplace, rightly requires safe access and supervision. Examples of the former included work performed to elevator car interiors and examples of the latter include work on sprinkler systems or building electrical equipment in elevator hoistways and pits.

I believe your task is to formulate uniform language that differentiate between these categories and finally clarify the appropriate supervision requirements.

Conclusion

I applaud the Division for holding the meeting last Tuesday and for encouraging this dialog. I have been very supportive of what I see as the new era at the Division, which began with the appointment of the current Principal. For too long prior, I perceived a certain entrenchment of ideology and lack of progressivity of action. This has clearly changed at present with your proactive work and that of your fellow seniors and the Principal. I encourage more of the same. I would suggest subscriptions to *Elevator World* for all Division engineers as well as attendance at industry trade shows, especially the annual NAEC Conventions/Expos. It is imperative that Division engineers be as well informed in the industry as is reasonably possible, especially with respect to the emerging, global trends, new technologies and product developments that are rapidly taking form throughout our industry. California was once the leader in the country in the development of elevator safety – and it could be again.

As stated in my opening, please feel free to contact me to discuss any of my specific comments or general industry issues. Thank you for your time and consideration.

Your servant,

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