New APTA Escalator Guidelines

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INTRODUCTION

In 1990, APTA developed the first true set of guidelines for heavy duty transit escalators in the United States. This effort took several years to develop. The input of several transit authority users and one manufacturer virtually changed the escalator industry in the United States. This guideline was not without its problems.

The primary technical details turned out to be highly proprietary to one overseas manufacturer. The adoption of these guidelines by many transit properties allowed this manufacturer to open a factory in the United States. The other manufacturers quickly fell behind in the transit escalator market.

In 1990 there were no suppliers of heavy duty escalators that complied with Buy America requirements. . Today, there are three manufacturers that can supply heavy duty escalators that comply with Buy America requirements. In August, 2000 the APTA Elevator/Escalator Technical Forum formed a working group to update the escalator guidelines. The goal was to:

1. Eliminate proprietary requirements.
2. Update code requirements.
3. Re-define step load design criteria.
4. Develop more performance based requirements.

This paper will summarize the major changes in the guidelines developed by the working group. As of this date, there have been two Working Group meetings, one in New York City and one in New Orleans. Several key decisions have been reached that are the subject of this paper.

The Working Group consists of the three U.S. escalators manufacturers, several consultants and transit properties. The final draft of this Working Group's efforts will be submitted to the entire Elevator/Escalator Task Force for review and comment in August, 2001.

DISCUSSION

The first decision was to develop a guideline, not a specification. Too many specification writers had taken the original document (that was never formally approved by APTA) and applied it inappropriately. Furthermore, the original document had been modified by consultants and transit properties to the point that the original document was hopelessly outdated.

It is important to remember the original intent of these guidelines as stated over a decade ago on the cover of the guidelines, "This guideline is not intended to be a 100%, ready process technical specification for all transit authorities. Each authority may find it necessary to make changes to suit their specific needs. However, the stringent provisions have been researched through all of the subcommittee members' combined experiences and, in general, reflect transit requirements and the urgent need for improved safety and reliability."

There are several sections of the proposed guidelines that are highlighted with a note to the specification writer regarding considerations to choices prepared by the Working Group. For example, part 1 of the guidelines provides submittal requirements.

These extensive drawing packages can take up to 4-6 months to develop. This lengthy approval process stalled many projects and delayed both the riding public and the transit authority of an appropriate escalator in the timeliest manner possible. There are circumstances where a fast track approach is appropriate and desirable. In that case, a two tiered approach for approvals is suggested in the new guidelines.

The intent of the fast track approach is not to ignore the importance of the component drawings. This two tiered approach will confirm vertical rise and the horizontal space, permitting drives, chains and other major procurement decisions to be made by the escalator manufacturer. The Contractor is still obligated to provide all components in conformance with every aspect of the actual specification.

Other key items address in the guidelines corrected errors due to age of the original document as well as the ongoing effort to make this a completely non proprietary document. In part 1, updates to codes, voltage and jurisdiction were changed to reflect issues that the specification writer and designer should consider.

1.08 SUBMITALS:

☐ *Baseline specification*

A. Shop drawings: Three (3) copies of the shop drawings shall be provided by the Contractor. Drawings shall include, but not be limited to, facsimile outline of escalator truss in profile and plan; facsimile elevation of escalator balustrade, and vertical section through balustrade and truss midway between working points. Drawings shall show truss stanchion; track system and supports; drive system; step nosing radius at upper and lower ends; drive chains and gear train; step chain or step links (including chain pitch, step, and trailer wheels); step assembly (including axle, step tread, frame, and riser); handrail system (including profile, guides, drive, and tension device); support details (including upper, lower, intermediate, and slip joint), balustrade deck cover, interior panels, skirt panels, and their moldings; safety switches and operating devices; motor and emergency brakes; floor plates; speed governor; metal gauges; radial, vertical, and horizontal dimensions required for manufacture, and positions of lower and upper working points; attachment of truss to structure; major mechanical and electrical components within truss; drainage and electrical interfaces; hand and finger guards; ceiling intersection guards; passenger instruction signs; emergency stop button; and operating panel in upper and lower balustrades (including stop button, start and direction selection switches, and fault finder receptacle). Also, a complete schematic diagram shall be provided for the controller and all electrical devices. Test certificates for step chain shall be provided for approval.

Comment: the specifier should stipulate a time frame to obtain these drawings.

☐ *Optional specification for fast track projects:*

A. Shop drawings: Three (3) copies of the shop drawings shall be provided by the Contractor for approval within three weeks of notice to proceed. Drawings shall include, but not be limited to, facsimile outline of escalator truss in profile and plan; facsimile elevation of escalator balustrade, and vertical section through balustrade and truss midway between working points.

B. Record drawings shall be submitted for the following: Drawings shall show truss stanchion; track system and supports; drive system; step nosing radius at upper and lower ends; drive chains and gear train; step chain or step links (including chain pitch, step, and trailer wheels); step assembly (including axle, step tread, frame, and riser); handrail system (including profile, guides, drive, and tension device); support details (including upper, lower, intermediate, and slip joint), balustrade deck cover, interior panels, skirt panels, and their moldings; safety switches and operating devices; motor and emergency brakes; floor plates; speed governor; metal gauges; radial, vertical, and horizontal dimensions required for manufacture, and

Table 1.

A key example the specification writer must be aware of, is which version of the ASME A17.1 Elevator Code is in effect. The maximum speed of an escalator was 125 feet per minute until the 1999 addendum which limits the top speed of any escalator to 100 feet per minute. Depending on how deep the station is, this higher speed may be warranted, but careful attention must be paid to each local jurisdiction and which edition has been adopted.

The Americans with Disabilities Act has also been addressed in the guidelines. ADDAG has very few requirements for escalators that are not already established as part of ASME A17.1 code requirements. A key note in the guidelines is for the specification writer to understand that the minimum allowable step width of an escalator is 32 inches. A smaller dimension may be considered in an existing condition, but the designer and specification writer must consider this implication in their design.

Most transit authorities procure escalators from a General Contractor. The existing guidelines therefore, were overly burdensome on the escalator installer. The new guidelines removed general construction requirements for coordination and correction of issues not included in the responsibility specified in the escalator division.

Part 2 of the guidelines relate to the product itself. Several fundamental changes were made that differ from the original version of the APTA heavy duty escalator guidelines. Notably, all references to a particular manufacturer or model have been removed. As a performance guideline, this document is intended to open bidding as much as possible while providing the owner with an excellent and reliable escalator.

The escalator specification writer and designer need to understand that while there are only three manufacturers of these type escalators in the United State, there are many model choices dependant on rise, environment and load.

Manufacturer	Heavy Duty design/model
Fujitec, no specific model number	drive within step band drive outside step band drive outside or truss track radius, chain size and truss construction varies.
Schindler	9300-10 9300-20 9300-30 9700-10 9700-20 9700-30 track radius, chain size and truss construction varies.
Kone (formerly Montgomery, merged with O&K Escalators)	HD RTV-HD99 RTV-HD999 RTV-HD9999 track radius, chain size and truss construction varies.

Table 2.

It is important to note that not all of the models listed in the table above meet either version of the APTA escalator guidelines. This is precisely why all references to models and manufacturers was eliminated in this edition of the guidelines. Further, the new guidelines establish new performance criteria based on rise, or vertical travel.

CHANGES IN PERFORMANCE CRITERIA

Radius

According to the Consumer Product Safety Commission, the most common type of escalator accident is a fall due to a loss of balance. While not the most serious accidents (those are related to entrapment), the Working Group felt compelled to introduce standards to reduce any predictable hazard pattern possible.

In the past, the same transition radius was used regardless of rise. This posed difficulties in finding space for escalators of a typical height less than 20 feet. It was the consensus of the working group to develop specific performance requirements for escalators above and below 10 meters in rise.

Escalators over 10 meters in rise should have a minimum of three flat steps at both ends of the escalator and a significantly larger track radius of at least 2.5 meters.

The transition radius of an escalator is the distance it takes to move from a 30 degree incline to a 0 degree incline on the escalator. Since the head travels faster than the feet, an increase in the transition radius increases the arc in which the human head must travel. This is an important step in reducing this type of accident in the future.

Rise and type of escalator	upper radius	lower radius
Typical commercial department store under 7 meters	1 meter	1 meter
APTA Escalator guidelines under 10 meters	2.6 meters	2 meters
APTA Escalator guidelines over 10 meters	note to specification writer to increase at this rise, no specific radius is recommended for this custom application.	

Table 3.

Design Load

The next critical area of change is related to the design load. The original guidelines established a 674 pound per 40 inch step design load. This is more than 300% above the ASME A17.1 requirement. This standard was then applied to motors, chains, machinery and created havoc in the design of replacement escalators in particular.

As an example, in 1997, a 20 year old transit escalator was removed with a 7.5 horsepower motor and based on the new design load the new horsepower requirements increased to 34 horsepower! This required new electrical feeders in a very awkward location that cost over $100,000 to the project. This design load was deemed unreasonable and changed by the Working Group.

The new design loads are based on the higher European standards. The new guidelines are far more explicit in describing the requirements for each component of the escalators. All are in excess of current ASME A17.1 requirements, but are less than the original unreasonable standards of the initial guidelines.

Design Loads*	1000mm step	800 mm step
Static brake load	306 Kg (674 lbs.)	245 Kg (540 lbs.)
Dynamic brake load	145 Kg (320 lbs.)	116 Kg (255 lbs.)
Motor Duty	145 Kg (320 lbs.)	116 Kg (255 lbs.)

Table 4.

Safety Devices

In order to reduce confusion with ASME A17.1 code requirements which may vary by jurisdiction, all safety items required by A17.1 were removed from the specification in part 2. This redundancy could potentially develop an inconsistency depending on the version of A17.1 each jurisdiction had adopted. A note to the specification writer notes that they should consult their local codes if any particular safety device may not be included in their jurisdiction at that time.

Of particular note, ASME A17,1-d 2000 includes a dramatic change in the escalator code. The step to skirt gap, skirt construction, brush guards and “indexing” replace all previous requirements relating to these issues. It was the consensus of the Working Group to adopt this standard regardless of which version of ASME A17.1 or other local codes have adopted.

However, adoption of this standard must be examined carefully in every installation. This new standard has not been adopted in most jurisdictions since it is so new. Potential conflicts in its use where not yet adopted must be considered carefully. For more information on this new standard, the reader can go to the website for the National Elevator Industry Incorporated www.neii.org.

Components

Ornamental Metals

By far, the vast majority of escalators in transit have a solid stainless steel balustrade. Some transit facilities have a real problem with urination on escalators. To ensure a longer lasting finish to the stainless steel, a more urine resistant type of stainless steel, type 316 was recommended to the specification writer versus the standard type 304 stainless steel.

Exterior cladding of escalators has posed coordination problems in many transit escalator installations. The new guidelines clarify to the specification writer that this work belongs in the ornamental metals section of the specification, and that it must be coordinated with the escalator installer.

Motors and Drives

In the original guidelines, a proprietary design of motor and drive unit was specified. The new guidelines are now performance based and permit flexibility in design based on the individual needs of the transit property. A key note to the specification writer notes that while there is flexibility, some designs impact the building structure in a significant manner.

Specifically, the drive outside the truss is much more expensive than the designs in which the drive is within the truss. Due to special machine rooms, structural considerations, space may not be available if this design is selected without careful forethought. The note to the specification writer provides design alternatives with the warnings to coordinate design intent. This design flexibility will increase the bid list while protecting the owner from a surprise after the bids are opened.

Electronics

Proprietary controllers are both common and understood in the elevator portion of this industry. What is less known is the propagation of proprietary controllers in escalators. This poses several problems for the transit property. First, parts availability is restricted to one supplier. This has often posed substantial problems to transit properties in the past related to cost, lead time and availability.

Another important consideration is maintainability of the entire system. Most transit properties have a variety of elevators and escalators. Different vintages and manufacturers can make maintenance for either third party contractors or the authority itself difficult. At times, this variety discourages competition when bidding third party maintenance agreements.

The Working Group has agreed that this is an important issue and is changing the guidelines related to the controller section of the new guidelines. The primary goals will be to establish a non proprietary design for escalator controllers that the manufacturers can provide and the transit authorities

can maintain. At the deadline for this article, the Working Group was considering a PLC based design for those controls. The final decision of the Working Group should be available in April, 2001 and will be published shortly thereafter.

Weather Protection

Effective corrosion and weather protection is essential to ensure a longer design life of a transit escalator. The guidelines were updated for new technology for truss corrosion protection, permitting an alternative to hot dip galvanizing. Fastener requirements were upgraded and painting of the escalator steps was eliminated. A natural aluminum finish is more durable and maintainable than an aluminum finish painted step.

Steps and Chains

An important decision was made regarding the step chains and steps. After some debate, the Working Group decided to retain the 4 inch dimension on both the step and chain rollers. All of the manufacturers have models that provide this size roller and agreed that this requirement was not exclusionary.

The chain braking load was revised to match the motor load and the safety factor was increased from 5 to 6. This is a significant improvement over the ASME A17.1 minimum requirement. The step chain will also be required to have at least two one axle sections. This will improve the ability to maintain the step chain as it stretches over time instead of replacing the entire step chain.

CONCLUSION

After the April, 2001 meeting, the Working Group will finish the first APTA sponsored changes to the heavy duty escalator guidelines in over ten years. The remaining topics to resolve in April are related to decisions on the controller, handrail design, lubrication recommendations and in part 3 of the guidelines relating to the execution of the installation.

When complete, this new guideline will provide the transit authority an effective tool to procure new heavy duty escalators. The options and notes will reduce the likelihood of misuse of the guidelines. The end result will be an escalator that is more maintainable and designed appropriately for the application for which it is intended to operate for the next 30 years.