1967	**Chairman, Florida Industrial Commission** Elevator and Escalator Safety Seminar
1963-1964	**Gunderlin Limited, Inc.** - Hialeah, Florida Sales Manager - Elevator Cab & Entrance Manufacturer
1957-1963	**Westinghouse Electric Corp.-Elevator Division** - Atlanta, GA & Miami, Florida Sales Engineer - Escalators & Elevators Accident Investigations
1955-1957	**Continental Casualty Company** - Chicago, Illinois & New Orleans, Louisiana Agent - Special Risks Division

PATENTS:

Method and Apparatus for Entrapment Prevention and Lateral Guidance in Passenger Conveyor Systems.

Patent Filed:	May 28, 1981
First Patent Issued:	November 8, 1983
Second Patent Issued:	May 28, 1985

U.S. Patent No. 4,413,719 of 11/8/83
U.S. Patent No. 4,519,490 of 5/28/85
Canadian Patent No. 1,187,441 of 5/12/85
Italian Patent No. 1,159,267 of 2/25/87
European Patent No. 0079957 of 1/27/88

PROFESSIONAL ORGANIZATIONS:

National Association of Elevator Contractors (NAEC)
President, 1973-1974
Member, Board of Directors, 1972-1975

National Association of Elevator Safety Authorities (NAESA)

National Association of Vertical Transportation Professionals (NAVTP)

International Association of Elevator Engineers (IAEE)

Member of the Escalator & Moving Walk Committee of the American Society of Mechanical Engineers (ASME) A17.1 Safety Code for Elevators and Escalators

American Society of Safety Engineers (ASSE)

LICENSES:

Master Elevator and Escalator Installation and Maintenance; Metropolitan Dade County, (Miami), Florida

PAPERS AND PUBLICATIONS:

"APTA Subcommittee For Elevators and Escalators 1994 Meeting", Elevator World, March 1995

"Escalator Overspeed Revisited", Elevator World, August 1994

"Rubber and Brush Skirt Guards", Elevator World, December 1990

"Escalator Overspeed", Elevator World, May 1989

"Escalator Accident Statistics and Safety", Speech to National Association of Elevator Safety Authorities, Published by NAESA, January 1984

"Legal Principles of Escalator Accidents", Elevator World, August 1983

"Measuring Step Clearances and Inspection of Escalators and Moving Walks", August 5, 1982 - Published by NAESA, March 1983

SPEECHES:

04/11/96 - Northern Elevator Service Ltd. (Thyssen Elevator Group N.A.) - Toronto, Ontario - **"1996 Escalator Safety Seminar"**

04/21/95 - NAESA Western Regional Workshop, Las Vegas, NV - **"Escalator Safety"**

11/05/94 - N.A.V.T.P. Annual Meeting, Atlanta, GA - **"Brake Rated Loads vs. Real World Loads and Auxiliary Brakes"** and **"Computer Simulations of Elevator/Escalator Accidents for Demonstrative Evidence"**

10/17/94 - A.P.T.A. Annual Meeting, Washington, D.C. - **"Theoretical vs. 'Actual' Capacities and Brake Rated Loads"**

08/18/93 - NAESA Annual Workshop, Reno, NV - **"Escalator Accident Investigations"**

06/09/93 - American Public Transit Association (APTA) Rapid Transit Conference, Miami Beach, FL - **"Heavy Duty Escalator & Elevator Specifications"**

04/02/93 - NAESA Eastern Regional Workshop - Virginia Beach, VA - **"Escalator Accident Investigations"**

10/30/92 - NAESA Central Regional Workshop - Chicago, IL - **"Escalator Accident Investigations"**

10/28/92 - Massachusetts Elevator Safety Association - Boston, MA - **"Escalator Inspections & Accident Investigations"**

11/02/91 - NAESA Western Regional Workshop - Dallas, TX - **"Escalator Inspections & Accident Investigations"**

03/08/90 - American Society of Safety Engineers (Long Island Chapter) - Copiague, NY - **"Escalator Dangers"**

11/03/89 - NAESA Western Regional Workshop - Houston, TX - **"Escalator Inspections & Accident Investigations"**

11/04/88 - NAESA Annual Workshop - Milwaukee, WI - Panelist - **Escalator Cracker Barrel**

10/26/88 - Massachusetts Elevator Safety Association - Boston, MA - **"Types of Escalator Accidents"**

11/18/86 - Massachusetts Elevator Safety Association - Boston, MA - **"Escalator Inspection"**

08/10/83 - NAESA Annual Workshop - Chicago, IL - **"Escalator Accident Statistics and Safety"**

10/21/80 - NAEC Annual Convention - San Francisco, CA - **"Mergers and Acquisitions"**

04/02/80 - NAEC Mid-Year Seminar - Savannah, GA - **"Consultants: Friend or Foe"**

08/06/74 - NAESA Annual Workshop - Reno, NV - **"The Importance of Elevator Inspectors"**

TELEVISION APPEARANCES:

February 27 - 29, 1996	KMSP-TV Minneapolis/St. Paul, Minnesota - **"Shafted" Investigation**
January 5, 1996	**"A Current Affair" - "Escalators - A Current Affair Update"**
December 6, 1995	**CBS - "day & DATE" - "Stairway to Heaven"**
December 6, 1995	**CNBC - "Steals & Deals"** - Escalator Dangers & Safety
November 29, 1995	**Dateline NBC - "Moving Violations - Escalators-A Hidden Danger"**
November 27 - 28, 1995	WJW-TV (FOX) - Cleveland,OH **"Eight is News"** - Escalator Dangers
October 24, 1995	**"American Journal"** - Escalator Dangers & Safety
October 23, 1995	**"A Current Affair"** - Escalator Dangers & Safety
September 28 & 29, 1995	WDIV-TV (NBC) Detroit, MI - Nightly News series - **"Escalator Safety"**
March 1995	WCUA-TV (CBS) Philadelphia, PA - "The Herb Denenberg Show" - **"Escalator Safety"**

RADIO APPEARANCES:

December 16, 1995	Talk Radio with Janet Simons - KHOW-AM 630 - Denver, Colorado

ESCALATOR FACTORY TOURS:

O&K Escalators, Inc., Newport News, VA - 1992 & 1993
Haughton Elevator Company, Toledo, OH - 1975, 1976 & 1988
O&K Rolltreppen, Dortmund, Germany - 1987
Thyssen Fahrtreppen, Hamburg, Germany - 1987
Westinghouse Elevator Company, Randolph, NJ - 1981 & 1984
Montgomery Elevator Company, Moline, IL - 1964 & 1983

EXPERT WITNESS:

Qualified in **State Courts** in Alabama, Arkansas, District of Columbia, California, Colorado, Connecticut, Florida, Hawaii, Illinois, Iowa, Michigan, New Mexico, Ohio, Oklahoma, Oregon, Pennsylvania, Texas and Washington.

Qualified in **Federal Courts** in Arizona, Nevada, New York, Oklahoma, Texas and Virginia.

Carl J. White & Associates, Inc.

ELEVATOR & ESCALATOR CONSULTANTS

AIRPORT INDUSTRIAL PARK

5755-A INDUSTRIAL PLACE COLORADO SPRINGS, CO 80916-1797

(719) 550-0660 FAX (719) 550-0978

July 18, 1997

Mr. Nick Marchica
Director, E.S.M.E.
U.S. CONSUMER PRODUCT SAFETY COMMISSION
ESME, Room 611-20
4330 East West Highway
Bethesda, Maryland 20814

RE: OS No. 3523 CP 97-1 (Petition of Scott & Diana Anderson)
Dated April 9, 1997
Escalator Signage

Dear Mr. Marchica:

Although the escalator industry does not statistically report escalator accidents reported to them, the attached 1983 Otis Elevator Company "Guardian Escalator Skirt Retrofit" states that "...the second most common cause of escalator accidents...being caught between the side of the escalator step and the escalator skirt."

In spite of this reliably reported fact, the present ASME A17.1 sign (copy attached) does not warn passengers of this hazard. It is also improperly titled "Caution" in violation of the definitions of "ANSI Standard Z535.4 Product Safety Signs and Labels (June 1991)" attached. The correct title should be "Warning."

The attached "Warning" sign was submitted by one of the escalator manufacturers representatives on the A17.1 Escalator Committee several years ago, but was defeated by both this Committee and the Main Committee.

We would like to urge the Commission to require that this or an equivalent sign be installed on BOTH SIDES of escalators, at the top and the bottom landings, and be required for both new and existing escalators to better alert passengers pictorially to the hazards of side-of-step entrapments and falling.

Very truly yours,

CARL J. WHITE & ASSOCIATES, INC.

Carl J. White
President

CJW:dw
Enclosures

OTIS

GUARDIAN™

ESCALATOR SKIRT RETROFIT

Reduce Your Liability Risk

Otis Guardian™ skirt panels are easy to install and protect against the second most common cause of escalator accidents; foot entrapment. Guardian retrofits substantially reduce the possibility of a foot being caught between the side of the escalator step and the escalator skirt. When compared to the costs for the legal defense of only one liability suit, the protection offered by Guardian panels is economical as well as sensible.

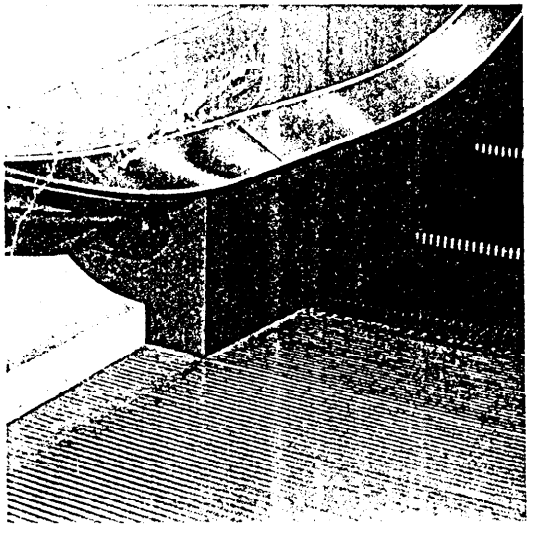
Drawing on our knowledge of advanced materials, we have designed these new safety skirt panels to have significantly less surface friction than your current escalator skirt panels. Guardian panels are virtually maintenance free and have a durable, attractive surface. There are no oils to apply, no silicone sprays, and no undesirable side effects in the operation of your escalator.

Protect yourself, protect your passengers, and obtain the satisfaction of knowing that your escalator safety equipment is up-to-date. Installation requires only a minimum of downtime, without special modification of the existing equipment, and with Guardian your escalator units meet the latest ANSI code.

Technical Description

Installation Features

Escalator skirts are the vertical portion of the escalator adjacent to the step. Guardian retrofits are a direct substitute for your current skirt panels. Each section is specifically designed to fit your Otis escalator, regardless of its age. No modification of existing equipment is needed other than the replacement of the skirt itself. Installation is fast and economical, while service interruption is kept to a minimum.



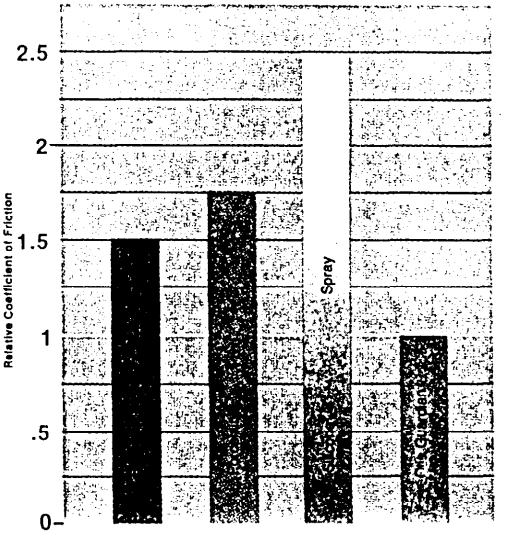
Passenger Protection

Foot entrapment accidents may happen with any type of shoe. Rubber-soled shoes, such as sneakers, are a particular problem. Unfortunately, children are frequently involved, and the number of liability suits is growing at an alarming rate. Guardian is a durable protection for both passengers and owners, resulting in a safer escalator system.

Surface Design

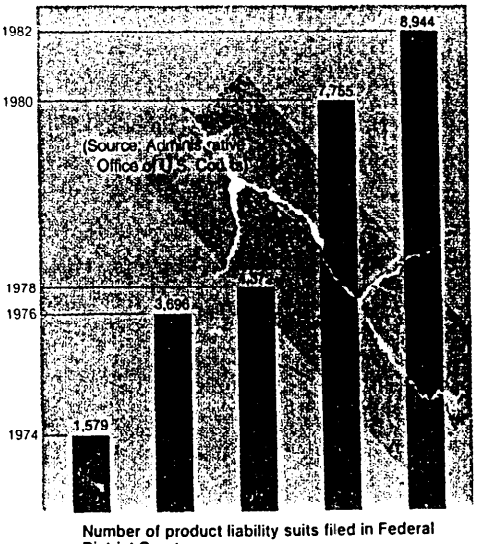
Guardian skirts are constructed from a widely used architectural metal selected for durability and attractive appearance. Its surface is a mixture of anodized aluminum impregnated with fluorocarbon resin providing maintenance free, low friction protection. The medium-grey color complements any balustrade treatment. No special applications are used, and no periodic reconditioning is needed. Field and laboratory testing have proven Guardian's outstanding low-friction characteristics. It's design and finish has one third less friction than stainless steel.

Skirt Panel Materials



Product Liability Chart

Liability protection is a concern to every owner and the number of product liability suits are represented in this chart.



Number of product liability suits filed in Federal District Courts

UNITED TECHNOLOGIES OTIS

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FIG. 805.9a CAUTION SIGN

§10.26A ANSI Standard for Product Safety Signs and Labels

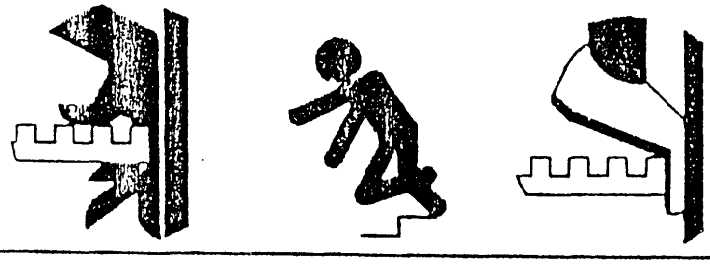
ANSI Standard Z535.4 Product Safety Signs and Labels (June 1991) sets forth a hazard communication system developed specifically for product safety signs and labels. Requirements for signs and labels used with hazardous chemicals, as defined in ANSI Z129.1 (1982), are not included in the scope of the standard. Product safety signs and labels are classified according to the relative seriousness of the hazard situation. The determination is based on an estimation of the likelihood of exposure to the hazardous situation and what could happen as a result of exposure to the hazard.

For products, there are three hazard classifications which are denoted by the signal words DANGER, WARNING, and CAUTION. DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations. WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

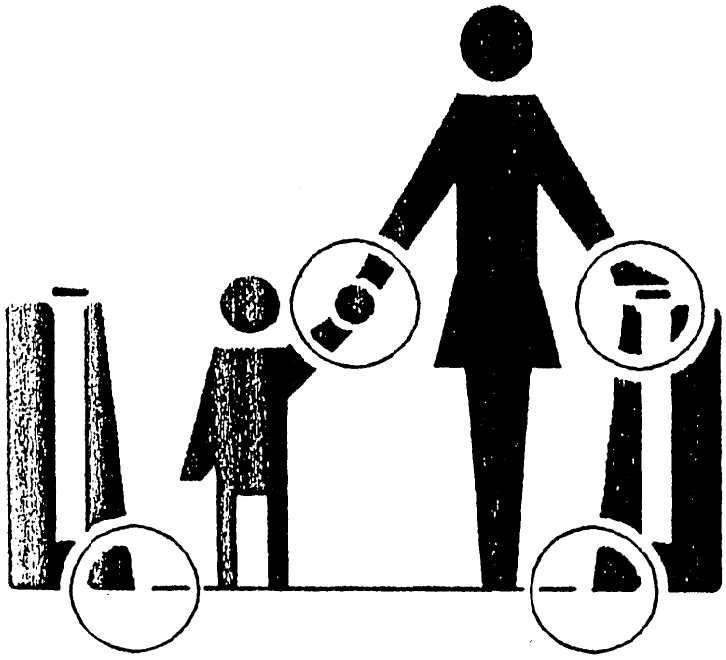
A product sign or label consists of a signal word panel plus a message panel. The signal word panel is the area of the safety sign containing the signal word. The message panel is that area of the safety sign containing the messages which identify the hazard, indicate how to avoid the hazard, and advise of the probable consequences of not avoiding the hazard. A pictorial panel may be used to communicate part, or all, of the elements of a message panel. A *pictorial* is a graphic representation intended to convey a message without the use of words. It may represent a hazard, a hazardous situation, a precaution to avoid a hazard, a result of not avoiding a hazard, or any combination of these messages. The latest draft of the standard notes that when a symbol/pictorial is used to convey any of the messages, the message(s) conveyed by the symbol/pictorial are not required to be repeated in word form in the message panel.

WARNING

Can Cause
Personal Injury



Passengers
Only



Hold Handrail
Attend Children
Avoid Sides

Carl J. White & Associates, Inc.

ELEVATOR & ESCALATOR CONSULTANTS

AIRPORT INDUSTRIAL PARK

5755-A INDUSTRIAL PLACE COLORADO SPRINGS, CO 80916-1797

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July 18, 1997

Mr. Nick Marchica
Director, E.S.M.E.
U.S. CONSUMER PRODUCT SAFETY COMMISSION
ESME, Room 611-20
4330 East West Highway
Bethesda, Maryland 20814

RE: OS No. 3523 CP 97-1 (Petition of Scott & Diana Anderson)
Dated April 9, 1997
Step/Skirt Testing Standards

Dear Mr. Marchica:

It has come to our attention that the National Elevator Industry, Inc. has retained Arthur D. Little, Inc. to assist the industry in developing a step/skirt performance testing standard which will be submitted to the A17.1 Escalator Committee and then to the A17.1 Main Committee for adoption to new and existing escalators.

It would seem obvious and it is well known that in order to comply with the Code provisions for the deflection of the skirt panel (Rule 802.3f(2)) and low friction of the skirt panel (Rule 802.3f(3)), escalator manufacturers would have and did historically perform such in-house testing standards.

Attached is a 22 page report titled "Step Skirt Phenomena" dated November 1996, authored by Mr. R. O. Schaeffer, Vice Chairman of the ASME A17.1 Escalator & Moving Walk Committee and recently retired Vice President of Montgomery KONE Elevator Company, in support of the above. We have added page 19 from the ASME A17.2.3-1994 Inspectors Manual and page 219 from A17.1 Part XII regarding friction reduction of the skirt panel.

A copy of the 25 sections referred to in Mr. Schaeffer's report is available upon request for the charge of reproduction and postage.

Very truly yours,

CARL J. WHITE & ASSOCIATES, INC.

Carl J. White
President

CJW:dw
Enclosures

X J

STEP SKIRT PHENOMENA
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5. Shoe positions -- semi rigid testing

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6. Shoe positions -- free shoe testing

6a. Free shoe test results -- chart form

7. Test results -- chart form

8. Conclusions

9. Branch Operations memo on silicone application

10. First production units to include stiff skirts silicone and 1/8" step gap (1978)

11. Memo to Branch Operations on results

12. Skirt stiffening package for customer use (1978)

EXHIBIT
Schaeffer
1
AJ 11-19-96

13. Liberty Mutual letter (December 1980) on effectiveness of siliconed skirts

14. Step-skirt tests (1984-85)

15. Skirt load deflection tests

16. Ongoing activities of Montgomery

17. Co-efficient of friction tests -- various skirt materials (1985)

18. Co-efficient of friction test on skirt panels (1987)

19. Skirt deflection tests (1988)

20. Review of jobs w/teflon impregnated aluminum skirts

21. Skirt deflection tests (1992)

22. Skirt comparison testing (1993)

23. Skirt deflection test (December 1993)

24. Commercial step gap closures

25. New York Transit Authority

R.O. Schaeffer
November 1996

STEP SKIRT PHENOMENA

During the late 1960's, it was brought to our attention that there were a small number of step skirt entrapments of small childrens shoes occurring. This was something totally new and we had not seen or heard of this type of incident prior to this point in time. The information we were receiving then, which was very small, indicated that they were occurring on down escalators. This, of course, was contrary to reason because on a down running escalator the step is moving away from the foot or the shoe and nothing should be causing the shoe to get caught between the step and skirt.

We also found that there was limited information available as to what was actually occurring and we did note that there was a new type of shoe or sandal coming into this country from overseas. They apparently were more of a soft, spongy type material and in some cases, what we would call a sticky or gummy type substance material being used for the soles. We thought that could be a factor. However, at that point in time, no one could tell us what had happened or why the few occurrences we were hearing about had occurred.

If we were to try and reproduce these accidents in order to reduce them, we needed an available escalator to use. It would not be practical to experiment on a commercial unit installed in a retail setting. We had built an escalator with 15 feet rise and installed it at our escalator factory to use as an experimental unit for testing all kinds of ideas. That unit was used for our testing.

With the limited information available to us at that point in time, I did try to re-construct what reports had been given to me described as catching of a shoe between the step and skirt. I tried various shoe sizes and different types of material but there was really no conclusive results for any of the various tests which I did conduct over a period of time.

In analyzing the action taking place at the point of ingestion, we did feel that there were probably three factors involved based on what information we had if people were not riding the escalator properly. These were the co-efficient of friction being produced between the skirt and various types of shoe materials, the width of the gap between the end of the step and the skirt, and most likely the stiffness of the skirt itself as the shoe moved along the incline of the escalator.

The skirts on the escalators we were importing from Germany from 1959 to mid 1960's were made of a light gauge sheet metal. They were supported at the vertical truss tube points and could vary in the range of 30" to 48" apart. They were relatively flat and straight and at mid point could be deflected. However, the step skirt gap has always been set at 1/8".

In the early 1970's, we began to collect data as to the frequency of these entrapments, as well as any other information available when an entrapment became known to us.

It is my recollection that there were about 30 per year reported and approximately six of those resulting in medical care of some kind. Most were scuffed shoes, but about one or two per year had an injury involving medical treatment. As more units were put into service, we were finding the number increasing as the years passed.

Over the years, the ANSI code has changed the step skirt clearance as follows:

1955	3/16" each side - 1/4" total
1960	same
1965	same - no limit if skirt switch used
1971	3/8" each side
1978	same
1981 - 1995	3/16" each side

During late 1974, early 1975, we undertook some tests as outlined in the LA Miles, December 1975 test data to determine what were the co-efficients of friction and how silicone or some other lubricant could effect the action between the various shoe and skirt materials.

We knew small children were involved, so therefore we selected the shoe sizes for a 2 year old, 4 year old, 6 year old, 8 year old, and 10 year old and their appropriate body weights, and then used the two types of skirtings which we were providing -- namely porcelain and stainless steel -- to conduct tests to determine the various co-efficient of friction. We also used an established method of determining co-efficients of friction which Otis had used some years prior and apparently were still using at that point in time. Therefore, any testing we were doing would then also be able to be correlated directly with any testing, for example, that they were doing or other people might be doing on the subject. Our tests showed that the co-efficient of friction was reduced at least 50% by use of a lubricant on the skirt panel.

Once it was determined that a lubricant would in fact reduce the co-efficient of friction between the shoe and the skirt, then the next question to be answered was the type of lubricant to be used. Under method 2 of the LA Miles test, eight (8) different silicone lubricants were tested. It was shown that a lubricant would reduce the co-efficient of friction significantly between the step and the skirt and the shoe. There was still an indication that step skirt incidents were occurring and if Montgomery was going to reduce them, we had to know why they occur, how they occur, and then how to prevent them from occurring in the future.

In order to adequately do all the tests involved, we needed an individual who had no pre-conceived ideas, was familiar with testing procedures, and could devote all his time

to this activity. In about late 1975, hired an individual with an Industrial Engineering background.

In order then to conduct the tests as outlined, we built special equipment which we refer to as a power pack which would allow us to get consistent, accurate readings in terms of pressures and as they varied throughout the tests. Also, in order to simulate or reproduce the entrapment of a child's foot, we then had to decide how this was to be done. Ultimately, mannequins were obtained with the various sizes of feet for the various age children.

The forward (section 2) then outlines a series of tests that were to be conducted in both the up and down directions with the step gap varying all the way from 1/16 to 3/8 inch at 1/16 variations. The side pressures were varied at 10 pound increments to 150 pounds and of course the various shoe sizes would be determined by the age, size, and weight of the child.

All these tests (section 3) were also to include both the dry condition of the skirt and a silicone or lubricated type of skirt. In addition to the so-called "tennis" shoe type, we also used the plain street shoe to see if there would be any difference with it. We also did all the tests on skirt panels as they were currently being installed on closed balustrade escalators.

The skirts that were used initially (1959) on Montgomery escalators were made of a light gauge sheet steel and formed. In the mid-1960's, I then converted over to a laminated type skirt. This design consisted of a 3/8" core of plywood faced on each side with a light gauge steel bonded to the core under heat and pressure. This gave us a 1/2" thick laminated panel.

This laminated skirt was installed in the escalator using steel plates and threaded rods; supported at each vertical truss tube. The top edge of the skirt was bolted in place with the bottom edge of the inner panel and a continuous aluminum trim strip.

In this report, we talk about a "stiffened" skirt. The stiffened skirt was the laminated skirt talked about in the preceding paragraph, with a metal channel attached to the bottom edge of the skirt panel.

In late 1977, we also did the same tests on closed balustrade escalator design with a stiffened skirt. When the final results of our testing were completed, it was shown that a stiff skirt was a factor. We found that the skirts on our glass balustrade escalators already exceeded a standard of 1/16" deflection at 150 pounds of force which was adopted by the 1981 A17.1 code.

A great deal of study went into selecting the type of silicone material to be used in these tests. There were a number of different products on the market and we needed to use a

product that would give us the best reduction in the co-efficient of friction and also be available commercially for use across our branch system. It also needed to be a material that would be retained on the skirt while subject to daily use by the riding public and not become contaminated by dust and dirt.

Daily logs were kept of the tests as conducted and by the time we had finished the testing, over 7000 tests or trips were done using the power back, mannequin leg, and of course the various sizes of tennis shoes. This covered a period of some 14 months.

Reference section 4 with this material is entitled "Summary" and it outlines the tests exactly as we ran them. This is followed by the results of those tests which shows that for dry skirts in the down direction with the regular skirt mounting and the semi-rigid test, there were no catches at the 1/16, 1/8, 3/16, 1/4, 5/16, and 3/8 gaps.

We were able, however, to get a number of shoes caught in the up direction starting at the 3/16" gap through the 3/8" gap. These are shown in the results of section 4.

We then did the same type of tests described above using the semi-rigid method but siliconed the skirts.

We did not test for the 1/16" and 1/8" gaps because we did not have any catches at these dimensions with dry skirts.

Since we had catches in the up direction at 3/16" through 3/8" with dry skirts, we then tested with silicone to determine its impact.

Starting there with the 3/16" gap, we did not have any catches in the up or down direction, no catches in the 1/4" gap up or down and no catches in the up direction of travel at the 5/16" gap. Since the only thing we changed was adding silicone to the skirts, which eliminated the catches, we concluded that silicone had to be a factor in eliminating these catches.

During the 1976-77 time period while we were conducting the semi-rigid tests with dry and siliconed skirts, and not being able to get anything caught with the siliconed skirt, we still had some reports of entrapment.

In trying to project how the entrapments were occurring, in the down direction, even though the semi-rigid tests did not duplicate the entrapments, they did show that nothing happened if the shoe was flat on the step. Therefore, we had to assume that the children were not standing or riding facing forward in a normal position and were probably pressing their feet against the skirt in some manner.

Because of the inability to get a shoe caught in the down direction using the semi-rigid method of testing, we then initiated another procedure which we called the free shoe test. This amounted to holding the tennis shoe on the escalator step at the nose,

middle, and heal and at the step-riser-skirt position physically forcing the shoe into that step skirt gap. With this testing, it was possible to get a shoe caught in the step-skirt-riser area.

Using the free shoe test, down direction, standard skirt mounting, dry skirts, and the over-the-nose position, we had 1 catch at 1/16" gap (10 year old), 9 catches at 1/8" gap (2, 4, 6, 10 year olds), 7 catches at 3/16" gap (2, 4, 6, 8, 10 year olds), and 6 catches at 5/16" gap (2, 4, 6, 8, 10 year olds).

At the nose, middle, and heal positions, there were no catches at all gaps and all ages.

At the back in the corner area, where the shoe contacts the tread-skirt-riser, we had four catches at the 1/16" gap (2, 4, 6, 10 year olds), 9 catches at the 1/8" gap (2, 4, 6, 10 year olds), 6 catches at the 3/16" gap (2, 4, 6, 8, 10 year olds, and 8 catches at the 5/16" gap (2, 4, 6, 8, 10 year olds).

In the semi-rigid tests, using currently installed skirts, we didn't test the 1/16, 1/8, or 3/16 gaps in the down direction. lubricated. because we hadn't caught anything in previous tests when the skirts were dry.

Since we had catches in the 3/16 and 1/4 gap dimension, up direction, we tested with silicone applied to the skirts. We caught nothing, so again concluded that silicone would significantly effect the ability of something becoming entrapped.

The testing we had done to this point in time showed that with siliconed skirts, we had no entrapments in either the up or down direction using the semi-rigid test.

However, using the free shoe test, (viii) we still had some catches or entrapments, with tennis shoes, down direction only, siliconed skirts, regular skirt mounting brackets.

We thought that even with the laminated skirt, that with the foot exerting a side pressure on the skirt, it might deflect a small amount between support points allowing entrapment.

Therefore, if we stiffened the skirt along the entire incline of the escalator, we could reduce the possibility of entrapments even more.

Then, going with the free shoe test, with the dry skirts, we used a stiffened skirt. In the down direction only, there were no catches at the 1/16 inch gap. At the 1/8" gap there was one catch at the over the nose position for a 2 year old, and no catches at the nose, middle, and heal positions. There were a total of four catches back in the corner for 2, 4, 6, 8 year olds where the step, skirt, and tread meet. At the 3/16 inch step gaps, there was one catch at the over the nose position for a 2 year old. There were no

catches at the nose, middle, and heal position. There was one catch for a 2 year old back in the corner where the step, tread, and skirt meet.

At the 1/4" gap, there were a total of five catches all over the nose position for 2, 4, 6, 8, 10 year olds. There were no catches at the nose, middle, and heal positions. There were a total of two catches back in the corner where the shoe meets the step, tread, and skirt (2, 8 year olds).

At the 5/16 gap, there were a total of five catches at the over the nose position for 2, 4, 6, 8, 10 year olds. No catches for the nose, middle, and heal position and a total of two catches back in the corner where the step, tread, and skirt meets (2, 8 year olds).

Then, in late 1977, with using the met-l-wood without a hat bracket and silicone sprayed skirts, there were no catches at the 1/16 inch gap, 1/8 inch gap, and 3/16 inch gap between the step and the skirt at any position.

At the 1/4" gap, there were a total of two over the nose position catches for 2 and 4 year olds, no catches at the nose, middle, or heal position. There was one catch back in the corner where the step, tread, and skirt meet.

At the 5/16 gap, there were a total of two catches over the nose position, for 2 and 4 year olds, no catches at the nose, middle, and heal positions, and no catch back in the corner.

In the final series of free shoe testing, using the reinforced skirt brackets and silicone there were no catches at the 1/16 inch, 1/8 inch, 3/16 inch step gap for all positions of the shoe. With the 1/4 inch step gap, there was one catch at the over the nose position for 2 year olds. There was no other catch at any other position.

Results of this testing then shows by <u>using a reinforced or stiffened skirt with the step gap at the 1/16, 1/8, and 3/16 inch and using a silicone treated skirt, we were be able to eliminate catches.</u>

Based on these results as confirmed by other sources, the A17.1 code was revised in 1981 to include a provision for applying a friction reducing agent to skirts and a requirement that the skirt have a maximum deflection of 1/16" at a force of 150 pounds.

Otis and Westinghouse were also conducting their own similar tests and had come to the same conclusions.

Section 8 of the total attached document gives the conclusions of the extensive testing which was conducted back in 1975-76. Several of them bear repeating. In spite of

extensive efforts, we were not able to get a shoe lodged in the down direction of travel if the shoe is riding or placed in the proper riding position. If the shoe is level and flat on the step treads, the shoe can even be rubbing against the skirt material but it is not forced into the gap in the down direction of travel. However, in the free shoe test, if the shoe is placed in an improper riding position, there is no lubricated skirt, skirt is not stiffened, the condition of the step gap is not small, then the possibility is that something can get caught.

These tests clearly document that in the down direction, that if the escalator is ridden properly by adults and children, no entrapment will occur between the step and skirt. Therefore, supervision of the rider, particularly children, is the primary deterrent to entrapment.

The results clearly show that if the skirts are treated with a friction reducing material, even if the step gap is 3/16 of an inch or less, and they have a stiffened skirt, then the possibility of an entrapment is very, very limited. In Montgomery's case, the step skirt gap has always been 1/8".

In March 1977 (section 9), we did issue a bulletin to all of our Branch people requesting that they should use the silicone spray on all installations they maintained and to also inform their customers of this practice.

Section 10 - the first ~~tread~~ Trial unit fitted with the reinforced skirts was at Stapleton airport on February 11, 1978.

In June of 1978 (section ~~9~~ 11), I then followed up with a memo to our Branch Operations people pointing out the results of the past two years testing and what additional steps we'd be taking and suggesting certain steps that the Branch people could be taking in order to obtain the results in the field which had been determined as a matter of this testing program.

The first production unit fitted with reinforced skirts was shipped in September 1978.

On October 19, 1978, Branch Operations issued a bulletin to all Branches (Section 12) within the continental U.S. advising them the skirt stiffener kit was available, what it was comprised of, how much it would cost, and we asked our factory to send the stiffener kit to the Branches involved with escalators that were in the construction process but had not yet been turned over for customer use. This would have been done at no cost to the customer. Also included with that memo was a letter proposing this to all the customers on record as of that date which the Branch should send and then follow-up to get a customer to add this to any existing escalators which they had.

Prior to December of 1980 (section 13), the Liberty Mutual people conducted a series of tests based on the assumption that any friction reducing material on the escalator skirts