

## **RE: Cleaning Efficacy / Entrance Flooring System Approach**

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### **MISSION:**

To determine the amount of soil our mat and grid products remove from foot and wheeled traffic. Analysis to compare results against benchmark cases of a VCT floor and a carpet runner. Data to show the amount of dirt unable to pass into a facility, therefore; demonstrating the comparative performance of each tested product.

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### **SUCCESS MEASURES:**

**Market & Business Goals:** Expand sales volume and new market avenues by promoting our expertise on the effectiveness of a systems approach to dirt retention.

**Internal Customer Value:** Ability to recommend specific tread inserts and product combinations for unique field applications.

**External Customer Value:** Means to appreciate benefit of systems approach, associated costs, and potential savings in interior cleaning costs, as well as; insight to the value of periodic product maintenance.

**Key Factors for Success:** Proper portrayal of data to easily understand the significance of systems approach. Correlation of results to quantify the amount of dirt retention to base cases for recommended product combinations. The analysis will develop a relationship between the frequency of traffic and the required length (traffic direction) of product.

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### **PROCEDURE:**

**Phase I:** Conduct initial evaluation for attached test protocol for Pedimat with carpet and dry debris.

Determine and implement adjustments as required to protocol.

Repeat initial trial and run a base case sampling. Review data with SBU Team.

**Phase II:** Perform “adjusted” protocol on several samples and both benchmark cases above!

Compare results and data with SBU Team.

**Phase III:** Perform protocol on systems approach. (benchmark cases if required)

Compare results and data with SBU Team.

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### **CONCLUSION:**

The results from these evaluations provide us with some useful information as to the performance of our entrance mat products to remove dirt from the soles of shoes, which typically carry dirt into a building entrance. During the evaluations, we initially improved the function of our apparatus to minimize the loss of test medium by changing the medium composition from 80% sand and 20% top soil to 100% dry sand, which closely replicates grit “picked-up” from paved or concrete surfaces. This dry medium scenario is typical to all building entrances at one time or another, subject to location and yearly climatic precipitation periods. Attachment “A” is cad detail depicting our testing apparatus.

The addition of moisture certainly compounds the performance and function of our products to perform in application. It is well known that moisture increases the propensity of grit to cling to the soles of shoes. This phenomenon mandated us to quantify the amount of moisture added to the test medium and also increase the amount of medium for the evaluation.

All of the data recorded during the evaluation stems from beginning with a predetermined amount of test medium. People walk across our test apparatus moving the test medium. All participants induce variables that factor into the evaluation due to their stride, manner of stepping action (heel to toe or ball of foot to heel), pace, and weight. All walkers first step into the tray containing the test medium. The soles of their shoes capture the medium due to the cohesive force of the medium to cling to the sole of the shoe, based upon the aforementioned parameters due to each participant. Immediately following the medium tray the participants travel across the evaluation samples. A complete pass around the apparatus occurs upon returning to the beginning point, after walking over perimeter mats that assist to remove medium not removed by evaluation samples. Prior to all tests we record each individual evaluation sample, underneath collection tray, and perimeter matting weights. After each test we again record all the above previous weights to determine:

- Amount of medium tracked by the participants throughout the test.
- Amount of medium collected on top or contained within each sample.
- Amount of fall through to underneath collection tray for each sample.
- Amount of medium to pass beyond samples to beginning point.
- Amount of medium loss

Note: Loss = tracked – collected – fall through – pass beyond

The following parameters are additional variables we controlled as constants during our evaluations:

- 3600 passes (laps) over all test samples. (approximate 11-12 steps on samples)
- Each participant wore sneakers for all evaluations.
- For 100 % dry sand medium, all evaluations started with 10 lbs.
- For our wet sand medium, all evaluations started with a 24 lb. mixture.

Note: dripless wet sand is by definition: 31.25% water

6.25% air

62.50% dry sand

Our Mixture – 15 lbs sand and 7.5 lbs of water! (balance is air)

- All weight measurements performed using same scale with +/- .002 lb calibration.
- All evaluation samples were 18 feet long (three 6 ft products defining a system)
- Within 6 ft products, singular sample size 2 foot long for ease of recording weight.
- After each evaluation clean and reweigh all products and collection trays.

Goal – return to original weight!

This conclusion lists only product combinations we are defining as a “systems approach” or Pedisystems. Our previous product knowledge and our internal singular product test data enabled the EFS SBU to decide on the following combinations as Pedisystems. The combinations parallel the zonal approach to dirt removal; zone 1 is a “scraper product”, zone 2 is a “trapping / drying product”, and zone 3 is a “finishing / drying product”. The Pedisystems with rating and rank for dry and wet test medium are as follows:

Pedisystems	Zone 1	Zone 2	Zone 3	Dry Results	Wet Results
A	DuroMat	PediTred II	Entrance Carpet	98.4% (2)	37.8% (3)
B	DuroMat	PediTred	Entrance Carpet	98.0% (4)	
C	DuroMat	Matrix Z2	Matrix Z3	96.0% (7)	
D	Matrix Z1	Matrix Z2	Matrix Z3	98.2% (3)	39.9% (1)
E	Entrance Carpet	PediTred	Matrix Z3	97.3% (6)	27.2% (5)
F	Matrix Z1	Pedimat	Matrix Z3	98.6% (1)	38.7% (2)
G	Matrix Z1	Pedigrid	Matrix Z3	98.0% (4)	
Reference	Runner	Runner	Runner		32.9% (4)
Average (see below)				97.8%	35.3%

Note: All C/S products tested with the heavy duty carpet insert!

For the evaluations of the Pedisystems the average of the tests are shown for both dry and wet mediums:

Category	Dry Medium (avg of 7 tests)		Wet Medium (avg of 5 tests)	
Initial amount	10 lbs		24 lbs	
Tracked medium	3.426 lbs	100% (34.3%)	21.751 lbs	100% (90.6%)
Sample medium removal	3.351 lbs	97.8%	7.678 lbs	35.3%
Up thru 6 feet	2.874 lbs	83.9%	3.589 lbs	16.5%
6 thru 12 feet	0.401 lbs	11.7%	1.936 lbs	8.9%
12 thru 18 feet	0.089 lbs	2.6%	2.153 lbs	9.9%
Medium beyond	0.038 lbs	1.1%	10.701lbs	49.2%
Medium lost	0.038 lbs	1.1%	3.371lbs	15.3%

- Note: 1. Attachments B & C contain a recap of all the dry and wet evaluations!  
 2. The excessive wet medium weight loss can be attributed to water evaporation and pulverization of the medium.

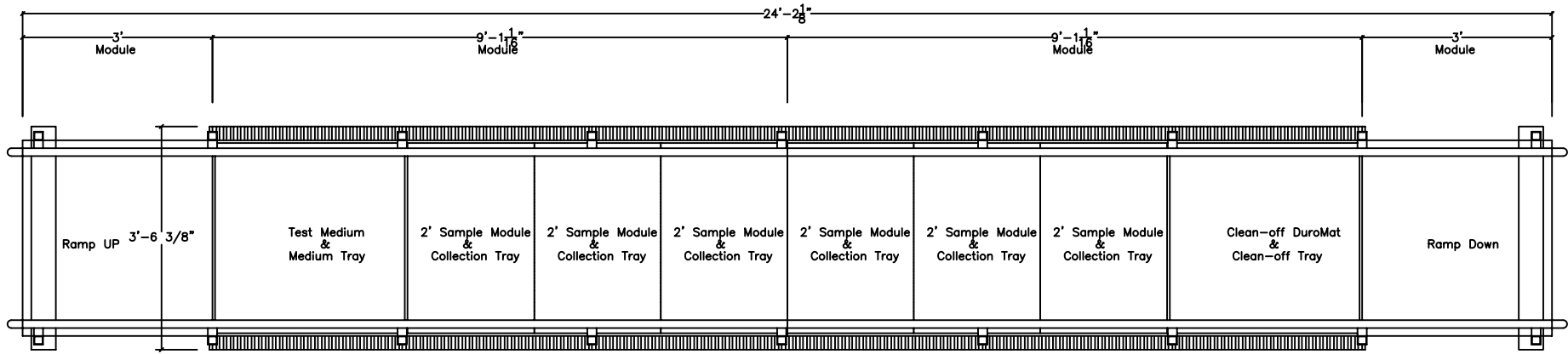
Comments on Test Evaluations:

- Dry medium test evaluations demonstrate all Pedisystems combinations performed very well. On average 83.9% of the test medium was captured in the first 6 feet.
- While the wet medium evaluations did not remove all the debris after 18 feet, it does demonstrate a significant increase in dirt removal in Zones 2 & 3 versus the dry medium evaluation.
  - Zone 2 – 4.82 times the amount of dry medium collected
  - Zone 3 – 24.19 times the amount of dry medium collected
- The initial amounts of test medium for tracking by the evaluation participants do represent worse case (accelerated) scenarios.
- The choice of a sneaker as the evaluation sole surface certainly provided a worse case scenario to track the test medium.
- It certainly seems reasonable that shoes with flat bottom soles (i.e. dress shoes) will tend to track less medium than soles with recesses such as sneakers.
- Our product combinations working as a scraper, trapper, or dryer should perform better on flat bottom soles.
- Due to the cohesive force of wet medium on the shoe sole surface, the wet medium ratings should increase, while the amount of tracked medium will decrease, for evaluations using a flat sole.
- Even with the amount of medium passing beyond the Pedisystems for the wet evaluations, all the product combinations did not reach their saturation points in capturing medium (absorption or fall through).
  - Each participant averaged 11 to 12 steps across the evaluation samples. Each sole had about 6 chances to have the medium removed by the stepping action. This is approximately two occurrences for scraping, trapping, and drying each sole.

Comments on product performance:

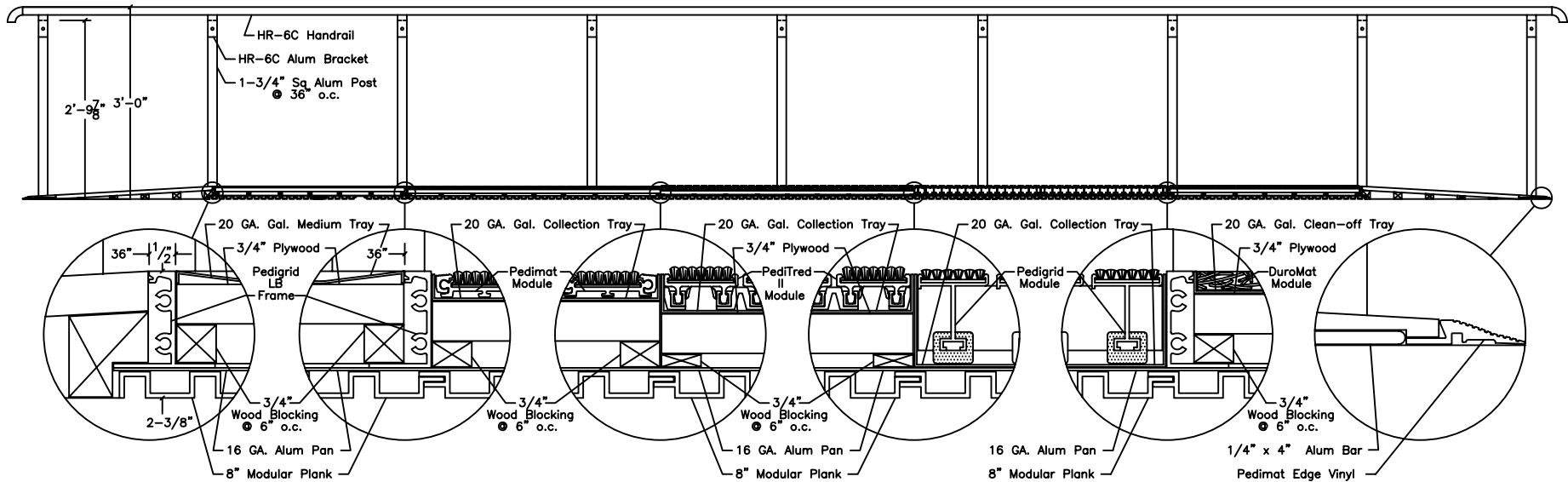
- The Matrix Z1 and DuroMat products performed very well as scraper products. Both products removed large amounts of fall through due to their free area and act as good trapping items. The nature of each product to yield under stepping action aids in the scrapping action. Additionally, they both clean up very easily with a power washer.
- While the Entrance Carpet is intended for exterior or zone 1 applications, the scrapping action is limited due to the nature of the product construction. The needle bonding technology creates a product that does not yield as much to the stepping action of a shoe sole. This minimizes the scrapping action of the product. The other point of significance deals with the free area of the construction. The scrapping action that does occur with this construction is limited to the fall through lying on top or within the texture of the product. This mandates more frequent cleaning. The Entrance Carpet does provide a better drying action than the Matrix Z1 or DuroMat.
- The Matrix Z2 performs well as a scrapping and trapping product for Zone 1 or 2. It also provides some drying action. For our evaluations it performed the best in Zone 2 due to the larger fall through potential enabling most of the medium to migrate underneath the mat.
- Our C/S entrance grids and mats with the heavy-duty carpet inserts performed well as scrapping, trapping and drying surfaces in Zone 2. While the majority of the removed medium became embedded within the tread insert or drain recesses between drain slots, the products cleaned up easily for continued function and service. The carpet inserts did yield under stepping action to scrape the medium from the shoe sole. The fall through of each of our products did parallel their free area ability. See Attachment D indicating the free areas of our grid and mat products.
- The Matrix Z3 and Entrance Carpet both did a good job as drying mats in Zone 3. Due to the Matrix Z3 to yield under stepping action, it did remove about 2% more dry and wet medium than the Entrance Carpet.

This conclusion now completes our objectives on this project. Each test cost us around \$500 dollars for the 3600 passes using the six hired participants. Each evaluation takes about 6 hours to set-up, perform and then record data. Our test apparatus is currently in storage. Please contact R&D to discuss or review any of the conclusion or attachments. All pertinent information on this initiative is in the project folder.



Proposed Cleaning Efficacy Apparatus for Mats & Grids

Plan View Above  
Horizontal Cross-Section Below



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PROPOSED  
CLEANING EFFICACY  
APPARATUS FOR MATS & GRIDS  
PRODUCT NO. 16ES-99-028

		APPR. BY	
		DWG. BY	D.E.A.
		DATE	5/12/99
		DRAWING NO.	RD-3435
NO.	REVISION	DATE	SHT OF

7/27/2000													
C/S Project 16ES-99-028													
Cleaning Efficacy													
Seven Tests - July 17 - July 25													
18 foot product combinations with 3600 passes over samples											<b>% Medium Removal</b>		
Sample #	Product 0 - 6 ft	Product 6 ft - 12 ft	Product 12 ft - 18 ft	Rating %		Sample #	Product 0 - 6 ft	Product 6 ft - 12 ft	Product 12 ft - 18 ft	Rating %			
1	DuroMat	PediTred II	Entr Carpet	98.4		1	83.8	13.1	1.5	98.4			
2	DuroMat	PediTred	Entr Carpet	98.0		2	82.4	14.8	0.6	98.0			
3	DuroMat	Matrix Z II	Matrix Z III	96.0		3	87.3	10.5	1.8	96.0			
4	Matrix Z I	Matrix Z II	Matrix Z III	98.2		4	80.4	13.6	4.3	98.2			
5	Entr Carpet	PediTred	Matrix Z III	97.3		5	84.3	9	4.1	97.3			
6	Matrix Z I	Pedimat	Matrix Z III	98.6		6	82.9	11.5	4.2	98.6			
7	Matrix Z I	Pedigrid	Matrix Z III	98.0		7	86.2	9.3	1.9	98.0			
						average	83.9	11.7	2.6	97.8			
<b>% Medium Removal Over Sample Length</b>													
Sample #	Product 0 - 2 ft	Product 2 ft - 4 ft	Product 4 ft - 6 ft	Product 6ft - 8 ft	Product 8 ft - 10 ft	Product 10 ft - 12 ft	Product 12 ft - 14 ft	Product 14 ft - 16 ft	Product 16 ft - 18 ft	Rating %	Beyond Sample %	Lost %	Medium Traveled lbs
1	43.6	26.0	14.2	6.2	5.4	1.5	0.6	0.5	0.4	98.4	1.2	0.4	3.418
2	43.0	23.1	16.3	6.5	6.4	1.9	0.3	0.2	0.1	98.0	1.1	0.9	4.322
3	49.9	21.2	16.2	4.6	4.4	1.5	0.9	0.5	0.4	96.0	0.9	3.1	3.838
4	43.8	21.8	14.8	6.5	4.8	2.3	1.8	1.5	1.0	98.2	0.9	0.9	3.946
5	48.4	21.7	14.2	4.2	3.5	1.3	1.8	2.0	0.3	97.3	1.4	1.3	2.956
6	48.0	21.1	13.8	5.2	4.2	2.1	2.0	1.3	0.9	98.6	1.3	0.2	2.560
7	56.2	17.9	12.1	3.9	3.3	2.1	0.7	0.5	0.7	98.0	1.0	1.0	2.942
average	47.6	21.8	14.5	5.3	4.6	1.8	1.2	0.9	0.5	97.8	1.1	1.1	3.426
<b>% Medium Contained Within Sample Length (requires cleaning)</b>													
Sample #	Product 0 - 2 ft	Product 2 ft - 4 ft	Product 4 ft - 6 ft	Product 6ft - 8 ft	Product 8 ft - 10 ft	Product 10 ft - 12 ft	Product 12 ft - 14 ft	Product 14 ft - 16 ft	Product 16 ft - 18 ft	Rating %	Beyond Sample %	Lost %	Medium Traveled lbs
1	3.9	2.5	0.9	5.0	4.5	1.2	0.6	0.5	0.4	19.5	1.2	0.4	3.418
2	2.4	1.6	1.2	5.9	6.1	1.9	0.3	0.2	0.1	19.6	1.1	0.9	4.322
3	3.2	1.6	1.2	2.0	1.9	0.8	0.9	0.5	0.4	12.6	0.9	3.1	3.838
4	0.4	0.3	0.3	4.0	2.6	1.3	1.8	1.5	1.0	13.0	0.9	0.9	3.946
5	48.4	21.7	14.2	3.7	3.0	0.9	1.8	2.0	0.3	95.9	1.4	1.3	2.956
6	0.4	0.5	0.2	4.3	3.5	1.6	2.0	1.3	0.9	14.5	1.3	0.2	2.560
7	0.3	0.5	0.4	2.0	2.1	1.5	0.7	0.5	0.7	9.4	1.0	1.0	2.942
average	8.4	4.1	2.6	3.8	3.4	1.3	1.2	0.9	0.5	26.4	1.1	1.1	3.426

9/21/2000													
C/S Project 16ES-99-028													
Cleaning Efficacy Medium: Dripless Wet Sand (24 lb mixture)													
Five Tests - Sept 13 - Sept 20													
18 foot product combinations with 3600 passes over samples											<b>% Medium Removal</b>		
Sample #	Product 0 - 6 ft	Product 6 ft - 12 ft	Product 12 ft - 18 ft	Rating %		Sample #	Product 0 - 6 ft	Product 6 ft - 12 ft	Product 12 ft - 18 ft	Rating %			
1	DuroMat	PediTred II	Entr Carpet	37.8		1	20.4	9.5	7.9	37.8			
2	Matrix Z I	Matrix Z II	Matrix Z III	39.9		2	19.6	11.1	9.2	39.9			
3	Entr Carpet	PediTred	Matrix Z III	27.2		3	10.7	7.7	8.8	27.2			
4	Matrix Z I	Pedimat	Matrix Z III	38.7		4	20.5	5.5	12.7	38.7			
5	Runner	Runner	Runner	32.9		5	11.4	10.7	10.7	32.9			
						average	16.5	8.9	9.9	35.3			
<b>% Medium Removal Over Sample Length</b>													
Sample #	Product 0 - 2 ft	Product 2 ft - 4 ft	Product 4 ft - 6 ft	Product 6ft - 8 ft	Product 8 ft - 10 ft	Product 10 ft - 12 ft	Product 12 ft - 14 ft	Product 14 ft - 16 ft	Product 16 ft - 18 ft	Rating %	Beyond Sample %	Lost %	Medium Traveled lbs
1	8.3	6.2	5.9	3.7	3.1	2.7	2.4	2.8	2.7	37.8	46.8	15.4	21.656
2	11.4	5.4	2.8	3.8	3.7	3.6	3.4	3.5	2.3	39.9	44.7	15.4	21.328
3	3.6	3.2	3.8	2.5	2.6	2.5	2.8	2.8	3.3	27.2	64.9	7.9	21.506
4	9.5	6.9	4.1	1.2	2.2	2.0	4.5	3.5	4.7	38.7	41.3	20.0	21.862
5	3.7	4.0	3.9	3.3	3.5	3.8	3.5	3.6	3.6	32.9	48.3	18.9	22.402
average	7.3	5.1	4.1	2.9	3.0	2.9	3.3	3.2	3.3	35.3	49.2	15.5	21.751
<b>% Medium Contained Within Sample Length (requires cleaning)</b>													
Sample #	Product 0 - 2 ft	Product 2 ft - 4 ft	Product 4 ft - 6 ft	Product 6ft - 8 ft	Product 8 ft - 10 ft	Product 10 ft - 12 ft	Product 12 ft - 14 ft	Product 14 ft - 16 ft	Product 16 ft - 18 ft	Rating %	Beyond Sample %	Lost %	Medium Traveled lbs
1	5.6	4.0	4.0	2.3	2.3	1.9	2.4	2.8	2.7	28.0	46.8	15.4	21.656
2	3.5	1.1	0.6	2.5	2.4	3.4	3.4	3.5	2.3	21.9	44.7	15.4	21.328
3	3.6	3.2	3.8	2.4	2.4	2.3	2.8	2.8	3.3	26.5	64.9	7.9	21.506
4	2.8	1.6	0.8	0.6	1.7	1.5	4.5	3.5	4.7	21.7	41.3	20.0	21.862
5	3.7	4.0	3.9	3.3	3.5	3.8	3.5	3.6	3.6	32.9	48.3	18.9	22.402
average	3.8	2.8	2.6	2.2	2.5	2.6	3.3	3.2	3.3	26.2	49.2	15.5	21.751

12/13/2000										
C/S Entrance Products										
Free Area Calculations										
Pedigrid width	Pedigrid TD	Pedigrid Area	# of gaps & rails	# of key lock bars	typical rail gap	key bar thickness	tread rail length	total open area	% free area	area sq ft
12	12	144	8	2	0.123	0.125	11.875	12.939	8.99%	1
24	24	576	16	3	0.123	0.125	23.875	49.248	8.55%	4
36	36	1296	24	4	0.123	0.125	35.875	108.927	8.40%	9
144	36	5184	24	15	0.123	0.125	143.875	423.684	8.17%	36
144	72	10368	48	15	0.123	0.125	143.875	847.368	8.17%	72
144	144	20736	96	15	0.123	0.125	143.875	1694.736	8.17%	144
Pedigrid II width	Pedigrid II TD	Pedigrid II Area	# of gaps	drain spacing	drain area	# of drains per gap	tread rail length	total open area	% free area	area sq ft
12	12	144	7	3	0.120	4	11.875	6.353	4.41%	1
24	24	576	15	3	0.120	8	23.875	20.370	3.54%	4
36	36	1296	23	3	0.120	12	35.875	42.052	3.24%	9
144	36	5184	23	3	0.120	48	143.875	154.708	2.98%	36
144	72	10368	47	3	0.120	48	143.875	297.163	2.87%	72
144	144	20736	95	3	0.120	48	143.875	582.075	2.81%	144
PediTred width	PediTred TD	PediTred Area	# of gaps # of hinges	drain spacing	drain area	# of drains per gap	tread rail length	total open area	% free area	area sq ft
12	12	144	7	3	0.120	4	11.875	6.832	4.74%	1
24	24	576	15	3	0.120	8	23.875	23.244	4.04%	4
36	36	1296	23	3	0.120	12	35.875	49.237	3.80%	9
144	36	5184	23	3	0.120	48	143.875	183.448	3.54%	36
144	72	10368	47	3	0.120	48	143.875	360.393	3.48%	72
144	144	20736	95	3	0.120	48	143.875	714.283	3.44%	144
PediTred II width	PediTred II TD	PediTred II Area	# of gaps	drain spacing	drain area	# of drains per gap	tread rail length	total open area	% free area	area sq ft
12	12	144	7	1.5	0.120	8	11.875	9.706	6.74%	1
24	24	576	15	1.5	0.120	16	23.875	34.741	6.03%	4
36	36	1296	23	1.5	0.120	24	35.875	75.104	5.80%	9
144	36	5184	23	1.5	0.120	96	143.875	286.915	5.53%	36
144	72	10368	47	1.5	0.120	96	143.875	567.327	5.47%	72
144	144	20736	95	1.5	0.120	96	143.875	1128.150	5.44%	144
Pedimat width	Pedimat TD	Pedimat Area	# of gaps	drain spacing	drain area	# of drains per gap	tread rail length	total open area	% free area	area sq ft
12	12	144	5	1.5	0.120	8	11.875	7.790	5.41%	1
24	24	576	11	1.5	0.120	16	23.875	27.077	4.70%	4
36	36	1296	17	1.5	0.120	24	35.875	57.859	4.46%	9
144	36	5184	17	1.5	0.120	96	143.875	217.937	4.20%	36
144	72	10368	35	1.5	0.120	96	143.875	429.371	4.14%	72
144	144	20736	71	1.5	0.120	96	143.875	852.238	4.11%	144