

DIAMOND PIER®

National Performance Submittals, 2005

The submittals enclosed, specific to frost and heave, were provided to the ICC in 2005 in order to justify condition 5.3 of the ESR report, which allows for the local approval of Diamond Piers for attached decks where frost protection is required.

Please note:

Condition 5.3 references Exception 3 in 2006 IRC Section 403.1.4.1 stating “Decks not supported by a dwelling need not be provided with footings that extend below the frost line.” Per the ICC Acceptance Criteria 336 public hearing on the Diamond Pier, this Exception 3 is permitted to be *exceeded* based on the Diamond Pier’s submitted successful performance in frost. It is not intended to limit Diamond Pier’s use to only detached decks and structures.

KUDRNA & ASSOCIATES, LTD.

CIVIL ENGINEERING
PLANNING • DESIGN • LAND SURVEY • CONSTRUCTION MANAGEMENT

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September 23, 2005

ICC-Evaluation Service
c/o David Pereg / Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

RE: AC 336

Dear Sirs:

Diamond Pier Foundation Systems (DPFS) by Pin Foundations, Inc. have been used on a number of varied projects throughout the Chicago metropolitan area since 1996. To date, there have been no owner or building official complaints regarding settlement or movement due to frost heave. The purpose of this letter is to provide a discussion of why the DPFS has performed so well over the years as well as a reasoned analysis showing that structures that are supported with DPFSs, decks and boardwalks in particular, should be exempted from the requirements of R403.1.4.1 Exception 2.

According to R403.1.4.1, decks and boardwalks that are freestanding do not require foundations that extend below the local frost line. Conversely, structures that are connected to a dwelling must have a foundation below the frost line. The purpose of this code provision is to ensure that foundation movements do not adversely impact the dwelling structure.

The typical connection between a dwelling and a deck includes a wood ledger that is connected to the dwelling's rim joist and deck joists that are connected to the ledger with face mounted hangars manufactured from light gage steel (e.g., Simpson Strong-Tie). These types of hangars are load rated for downward and uplift loads only. In other words, they have no capacity to resist rotational forces or bending moments. Further, the allowable loads for these hangars are derived from test data in which one of the criteria used in testing these hangars is a 1/8" installation gap. Additional load values are provided for an installation gap as large as 3/8". In most cases, the allowable loads for a 1/8" gap are the same as those for a 3/8" gap. See the attached literature from Simpson Strong-tie.

The issue of installation gaps is significant as it relates to the ledger connection in that a 1" foundation settlement (or heave) over the assumed 10'-0" span of a 2x8 joist produces a widening (narrowing) of the installation gap by only 1/16". Taken to the extreme of a 4" settlement (heave), the gap becomes 3/8" with nearly no impact on connection capacity.

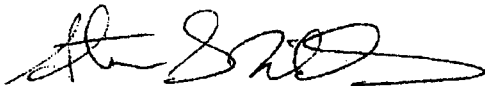
As I mentioned previously, these types of hangars provide no resistance to rotation due to their inherent flexibility. As a result, the fictitious 4" heave would cause the 1/8" installation gap to close at the top and open by an additional 1/4" to 3/8" at the bottom. Since these hangars are flexible with respect to bending loads, I feel that the hangar would deform slightly rather than causing any of the fasteners to withdraw. Since the hangar capacities are only slightly diminished at a 3/8" installation gap, it is likely that a 3/8" bottom-only gap would produce similar results.

On a separate issue, Section R403.1.4.1 states that "where otherwise protected from frost..." It is my opinion that DPFS, overall, satisfies the intent of this statement. The concrete portions of the piers are diamond shaped which allows heaving soil directly below the pier to be pushed to the side as it is forced upward. As a result, the angled shape receives only a small component of the total upward heaving force which greatly reduces the overall magnitude of any frost induced soil heave.

Further, the bearing pins that are driven through the concrete portion of the pier are often terminated near the frost line. If an ice lens forms between the ground surface and the bottom of the pins, the pins will serve to hold the soil mass together much like steel reinforcement in concrete and will serve as the anchoring force required to offset the remaining upward component of force on the bottom of the pier.

In summary, the Diamond Pier Foundation System provides protection from frost induced ground movement due to its shape, method of installation and its operation as an overall system. Further, if the surrounding soil does experience frost induced ground movement, it is my opinion that the magnitude of any such movement, as it relates to the Diamond Pier head and attached structure, will be significantly reduced as compared to the soil itself. And, finally, in the case of typical ledger connections, reasonable amounts of settlement or heave can easily be accommodated within the light gage hangar connections typically used in these applications. The Diamond Pier Foundation System provides an equivalent, durable and safe alternative to typical drilled concrete piers.

Respectfully submitted,



Steven S. Michels, S.E.
Project Manager
Kudrna & Associates, Ltd.

Attachment: Simpson Strong-Tie Technical Bulletin



**Boulder
Denver
Louisville
San Diego
Winter Park**

September 7, 2005

Larry Hanie
Adams County Department of Public Works
12200 North Pecos Street
Westminster, CO 80234

Re: Review of Diamond Pier DP 50 as Acceptable Alternative to 10" Diameter x 36" Deep
Concrete Residential Deck Piers

Dear Mr. Hanie:

Structural Engineers with Ascent Group, Inc. have reviewed both test data on the pin piers, provided by Diamond Piers, two five year old field installations of the product (Highlands Ranch Walkway & Arapahoe County Walkway) and our own experience with the foundation support of the 2002 & 2005 University of Colorado Solar Decathlon Entry Modular and Mobile homes, for the purpose of rendering an opinion as to the acceptability of the DP 50 as an adequate structural alternative to typical residential frost depth concrete deck piers. The following is a summary of our findings.

- Test data in low bearing soils conditions in Pacific Northwest locations show pin pier capacities significantly higher than the approximate capacity of a 10" concrete residential deck pier.
- The Highlands Ranch wood walkway bridge support pin piers show evidence of little or no movement despite erosion around the pins where the pins were installed in a stream bed and despite five frost cycles over the last five years. Note that code required live loading of the walkway is higher than residential decks.
- The Arapahoe County wetlands application for a wood walkway support also shows no significant movement after repeated water intrusion and frost cycles over the 5 years since installation. Note again, that code required live loading of the walkway is higher than residential decks.
- The 4 section modular CU Solar Decathlon entry for 2002 spent 3 weeks in Washington DC and 1 year on the Boulder Campus (full winter frost cycle) supported by Diamond Pier Pin Piers without noticeable changes in floor "levelness" or damage to interior floor, wall, ceiling finishes or the photovoltaic collectors on the entire roof. Note that combined snow and residential floor live loads are significantly larger than residential deck live loading.

Based upon this information, we believe that the Diamond Pier DP 50 pin pier product with (4)- 42" long pins is structurally equivalent to a 10" diameter x 36" concrete residential deck pier in non-expansive Colorado soils of at least 1,500 psf (allowable soil bearing capacity IRC 2003 Table R401.4.1). This assumes the Diamond Piers are properly installed per the Manufacturer's installation

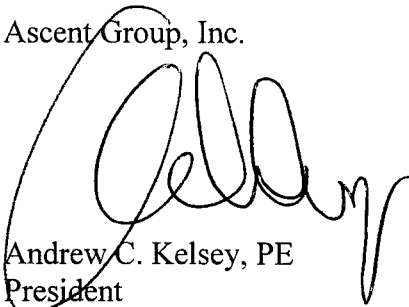
instructions, and inspected by a local building inspector according to the simple inspection requirements in the Manufacturer's Technical Manual. With proper installation and inspection, we believe that the Diamond Pier DP 50 is durable, safe and effective for the support of residential decks. Even with variable soils conditions in Colorado, the use of Diamond Piers as the exterior support of residential decks can be used in combination with typical structural ledger connections to residences.

Where soils are expansive, or weaker than 1500psf, or there are unusual loads associated with the deck structure, the use of longer or larger diameter Pins may be required. In such conditions, soils analysis, site specific capacity calculations and/or load tests may be required. Please contact Ascent Group, Inc. to provide site specific study for these conditions as necessary.

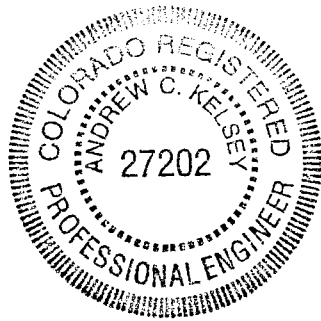
If you have any questions, please do not hesitate to contact us.

Sincerely,

Ascent Group, Inc.



Andrew C. Kelsey, PE
President





Andrew J. Spano
County Executive

Department of Planning

Gerard E. Mulligan
Commissioner

September 21, 2005

ICC-Evaluation Service
C/o David Pereg/Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

Subject: AC336

Dear Sirs:

I am writing in reference to a boardwalk which we installed in 2002, utilizing the diamond pier system, as manufactured by Pin Foundations. Typically, the depth to frost in this part of the country is 42".

As this boardwalk was installed over a 100' wide wetland, I was very concerned that we minimize the impact to the surrounding environment during construction. Therefore, we chose the diamond piers. Sure enough, during construction, the contractor has very little trouble installing the piers, and did not disturb much of the surrounding area.

Yesterday, September 20, 2005, we visited the site to inspect the quality of the boardwalk. The installation appears basically the same as the day it was completed. There has been no apparent settlement since the installation.

Sincerely,

Suzette B. Lopane, R.L.A.
Associate Planner-Urban Design

SBL/sbl

Enclosures

cc: Rick Gagliano, Pin Foundations



CITY OF MANCHESTER
Parks, Recreation & Cemetery Department

625 Mammoth Road
Manchester, NH 03104-5491
(603) 624-6565 Administrative Office
(603) 624-6514 Cemetery Division
(603) 624-6569 Fax

COMMISSION

George "Butch" Joseph, Chairman
Steve Johnson, Clerk
Michael Worsley
Dennis Smith
Sandra Lambert
Ronald Ludwig, Director

September 22, 2005

ICC – Evaluation Service
C/o David Pereg/ Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

Re: AC336

Dear Sirs:

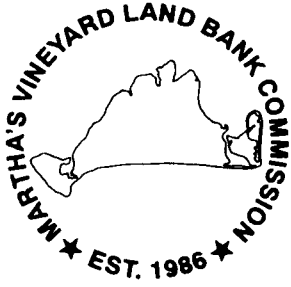
I am writing to inform you of the success we've had with the Diamond Pier Boardwalk system at Livingston Park here in Manchester, New Hampshire project # AC 336.

Given the strict regulations of our State Wetlands Bureau this product was the most logical choice given the minimal level of soil disturbance required for it's successful installation. This product was installed almost 2 years ago to support a 600-foot long boardwalk through a wetland and has survived two harsh winters with no noticeable evidence of settlement, heaving or movement of any kind. There has also been no visible evidence of physical deterioration in the product. Finally, it has withstood an enormous amount of foot traffic as this project has been very popular with the neighborhood and local community and we have been very pleased overall with it's performance

Best regards,

Chuck DePrima, Deputy Director

Cc: Rick Gagliano, Pin Foundations Inc.



Martha's Vineyard Land Bank Commission

ICC-Evaluation Service
c/o David Pereg /Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

RE: Project # AC 336

September 21, 2005

Dear ICC evaluators:

I am writing this letter to add support for the *Diamond Piers* product, which Pin Foundations Inc. manufacture. I'm the property foreman for the Martha's Vineyard Land Bank a public conservation agency with some 3,000 acres conserved and over 50 miles of trails under our management.

In the spring of 2004 I installed two elevated pedestrian boardwalks (one 3' X 65' and one 3' X 35') using 50# *Diamond Piers*. The piers were anchored with 5' schedule 40 galvanized pipe. The walks crossover two stream beds with a maximum span of 10' between piers. The winter of 2004 – 2005 in the northeast saw an extraordinary snow load of 3' plus for over 2 months (under the forest canopy), and prolonged cold temperatures of below 5 degrees drove the frost line down to 3 feet. Both boardwalks showed no sign of shift, heave or settling and in one instance a large tree limb had collapse onto the walkway decking, again with no sign if structural movement.

I have been completely satisfied with the *Diamond Pier* product; their ease of installment, the small footprint of site disturbance and their structural integrity has been outstanding.

Sincerely,

A handwritten signature in black ink, appearing to read "Matthew Dix", written over a horizontal line.

Matthew Dix
Property Foreman



United States Department of the Interior



NATIONAL PARK SERVICE
Sequoia and Kings Canyon National Parks
47050 Generals Highway
Three Rivers, California 93271-9651
(559) 565-3341

IN REPLY REFER TO:

Tyler Johnson
Maintenance Mechanic
Sequoia & Kings Canyon National Park
Ash Mountain Buildings & Grounds

To ICC-Evaluation Service
5360 Workman Mill Road
Whittier, CA 90601

Subject Re: AC 336

Dears ICC-Evaluation Service

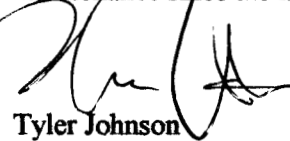
I was the project foremen in charge of the rehabilitation of a handicap assessable trail in Giant Forest during the summers in 1999-2000. The trail is at a 6000 ft elevation and during the winter averages an annual snow pack of 3-5 ft. Temperatures during the winter range from 10-40 degrees. This project required the construction of boardwalks using a foundation pier block that can be placed in wetlands. After reviewing the different products available the decision was made to use the *Diamond Piers & Pinning System*.

During the planning stages the *Diamond Piers* manufactures ask us to send soil samples down to 2 foot deep so they can determine the pin lengths needed to anchor the piers. The recommended pin lengths were determined at 5 ft so we ordered approximately 130 *Diamond Piers* and all the pins needed for the job.

During the construction the installation of the *Diamond Piers* worked very well and we needed no technical help from *Diamond Piers* manufactures during this process. I would purchase them again if needed.

Since then I have conducted annual inspections and have seen no problems of movement and settling. Some fallen trees impacted the boardwalks over the years damaging the timber structure but little or no movement of the piers.

The *Diamond Piers* have performed as promised with no problems during installation and has required no maintenance since then.



Tyler Johnson

TAKE PRIDE[®]
IN AMERICA 

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e-mail tfjmaeno@apple.kci.nc.jp

ICC-Evaluation Service
c/o David Perog/Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

September 15, 2005

Re : AC 336

Dear Sirs,

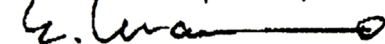
We have constructed boardwalks with Diamond Piers at 3 places in Hokkaido, the coldest and deepest snow area in Japan.

1. Takino boardwalk, 2m width and 300m long, built in June 2002 with Diamond Piers, located in Takino-Suzuran National Park. In winter season frost penetration reaches 0.6m and snow depth 2m. The boardwalk structure has passed 3 winter seasons but all Diamond Piers have not moved and whole wooden structure has stayed perfectly level. Top rails of handrail and all plankings have maintained level as well. There is no damage suffered from frost heave.
2. Ononuma boardwalk, 1.5m width and 100m long, built in September 2003 with Diamond Piers, located in a National Park. In winter season frost penetration reaches 1.0m and snow depth 2m. The boardwalk structure experienced 2 winter seasons but all Diamond Piers have not moved and whole wooden structure is perfectly sound. Top rails of handrail and all plankings have kept perfectly level. Foundations and whole structure have not suffered from frost heave at all.
3. Kushiro moor boardwalk, 2.0m width and 20m long, built in November 2004, located in a National Park (registered wetland with Ramsar Convention). In winter season frost penetration reaches 1m and snow depth 2m. Diamond Piers have experienced only one winter season but foundations and whole structure have not suffered from frost heave either.

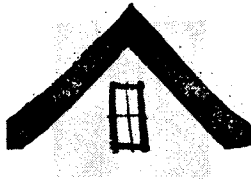
We constructed 3 boardwalks in National Parks in Hokkaido. Administrators of these parks requested us to build boardwalks with minimal excavation reducing erosion and to maintain natural vegetation of the jobsite as much as possible. They watched our construction all along, and all of them are satisfied with Diamond Piers.

Best regards,

TimberForm Japan Co., Ltd.



Eiji Maeno
President



LIVING SHELTER DESIGN ARCHITECTS, PLLC

eco-logical innovation for sustainable homes and communities

425-427-8643

888-248-2114

Fax: 425-427-8859

ICC Evaluation Service
c/o David Pereg / Brian Gerber
5360 Workman Mill Road
Wittier, CA. 90601

Re: AC 336

Dear Sirs:

I am writing this letter in support of the Pin Foundation system. In our office we design custom homes primarily, and our focus is on making these homes as environmentally responsible as possible. We've specified the Pin system on multiple projects, but the most extensive use was on a straw bale demonstration home located on Bainbridge Island, Washington. The home sits at the edge of a Class III wetland. In fact, during wet seasons a portion of the standing water reaches the Pin Foundations of the deck. The use of the Pin Foundation system is important to the design and demonstration that less invasive options are available for the built environment.

The pins were installed in the summer of 2003, and the home and deck have been in place for two years now. Differential settlement of straw bale walls can be a concern, and is easily apparent if it is occurring because of cracking in the plaster skin. I recently had the opportunity to visit the site (September 12, 2005) and I saw no evidence of movement, no cracks in the plaster. The connection of the deck to the house looks the same as it did in 2003, leading me to believe that there is no movement in the deck either. The ground at the base of the piers also looks unchanged.

If you have further questions regarding this project, or our feelings regarding the use of the Pin Foundation system please feel free to contact me.

Sincerely,



9.14.05

Dallas Green
Project Manager



3280 Redstone Park Circle
Highlands Ranch, Colorado 80129
303-791-2710
303-791-3047 Fax
www.highlandsranch.org

September 2, 2005

ICC-Evaluation Service
c/o David Pereg /Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

Re: Project #AC 336
Marcy Gulch Bridge

Dear Sirs:

I am writing at the request of Rick Gagliano with Pin Foundations Incorporated to comment on how their pin foundations have performed on one of our projects.

Our Marcy Gulch Bridge project was built in 2000 over a perennial stream with varying water level fluctuations. The 100 foot bridge is primarily wood piers over pin foundations supporting wood beams, decking and rails. The bridge is supported in several locations by PFI Diamond Piers centrally located in areas that are subject to changing water flows and elevations. Structural design in our region normally takes into account for 36" of frost depth.

Since our project has been built I have seen sediment deposition in the stream bed to almost the top elevation of the Diamond Piers and periods of scouring to just beneath the pier head. None of these situations, including our cold winters, have affected the structural integrity of the structure nor have we seen any movement of the bridge members or piers themselves. So far, we are very pleased with how the product has performed. I have attached a few photos of the project.

Please feel free to call me anytime if you have any other general questions about the project. Specific technical questions may be referred to our consultant for the project, Mark Taylor at Architerra, 303-948-0766.

Sincerely,

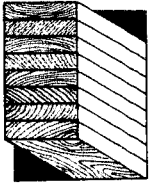
A handwritten signature in black ink that reads "Brian Muller". The signature is fluid and cursive, written over the printed name.

Brian Muller
Park Planning Manager

BJM

Enclosure: bridge photos

Cc: Rick Gagliano, PFI
Mark Taylor, Architerra



WESTERN WOOD STRUCTURES, INC.

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Fax: (503) 692-6434

wksi@westernwoodstructures.com
www.westernwoodstructures.com

September 20, 2005

ICC-Evaluation Service
c/o David Pereg /Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

Re: AC 336

Dear Sirs:

Western Wood Structures, Inc. has used the Diamond Pier foundation systems by Pin Foundations, Inc. on five timber pedestrian bridge/elevated walkway projects in the last two years. I inspected four of these projects, consisting of six bridge structures, today to determine if foundation settlement has taken place. Two of the projects had asphalt wear surfaces on the paths leading up to the bridge and the other two had gravel or wood chip paths approaching the bridge. On the two bridges where an asphalt path led to the bridge, I could determine if the bridge had settled with respect to the path. On all of the projects I used a 48" carpenter's level to determine if the bridge was level in the transverse direction. I also examined the framing of the timber bridges/elevated walkways to look for movement within the joints. These movements are indicators of foundation settlements. My findings are summarized below:

Mitchell Park Bridge. Portland, Oregon (Cedar Mill area)

Owner: Tualatin Hills Park and Recreation District

Bridge Installation Date: April 2005

6'-0" wide by 30'-0" long timber pedestrian bridge with three DP-100 piers and (4) 2" diameter x 63" pipe pins each end.

Dead Load reaction = 3,025 lbs. each end.

Live Load reaction = 8,160 lbs. each end.

There was no apparent settlement from the approach walkway to the end of the bridge.

The bridge was level from side to side. Measurements were taken on both ends.

There were no movements in the timber joints.

Rock Creek Powerline Park Bridge Portland, Oregon (Bethany area)

Owner: Tualatin Hills Park and Recreation District

Bridge Installation Date: September 2004

8'-0" wide by 75'-7" long timber elevated walkway (20'-11", 30'-4" and 24'-4" sections)

with two DP-100 piers and (4) 2" diameter x 63" pipe pins each end of each section. (12 total)

Dead Load reaction = 2,595 lbs. each end.

Live Load reaction = 8,610 lbs. each end.

There was no apparent settlement from the approach walkway to the end of the bridge.

The bridge was level from side to side. Measurements were taken at both ends and at one interior bent.

There were no movements in the timber joints.

Crowell Court Bridge. Beaverton, Oregon

Owner: Tualatin Hills Park and Recreation District

Bridge Installation Date: January 2005

6'-0" wide by 25'-0" long timber pedestrian bridge with two DP-100 piers and (4) 2" diameter x 63" pipe pins each end.

Dead Load reaction = 2,225 lbs. each end.

Live Load reaction = 7,500 lbs. each end.

There was no apparent settlement from the approach walkway to the end of the bridge.

The bridge was level from side to side. Measurements were taken on both ends.

There were no movements in the timber joints.

Arbor Oaks Bridges. Aloha, Oregon

Owner: Arbor Custom Homes

Bridge Installation Date: February 2004

Bridge #1

8'-0" wide by 144'-0" long timber elevated walkway (twelve 12'-0" sections) with two DP-100 piers and (4) 2" diameter x 63" pipe pins at each end and two DP-100 piers intermediate timber bents. (26 piers total)

Bridge #2

8'-0" wide by 72'-0" long timber elevated walkway (six 12'-0" sections) with two DP-100 piers and (4) 2" diameter x 63" pipe pins at each end and two DP-100 piers intermediate timber bents. (14 piers total)

Bridge #3

8'-0" wide by 24'-0" long timber elevated walkway (two 12'-0" sections) with two DP-100 piers and (4) 2" diameter x 63" pipe pins at each end and two DP-100 piers intermediate timber bents. (6 piers total)

Dead Load reaction = 490 lbs. each end.

= 980 lbs. at interior bents

Live Load reaction = 2,120 lbs. each end.

= 4,240 lbs. at interior bents

There was no apparent settlement from the approach walkway to the end of the bridge.

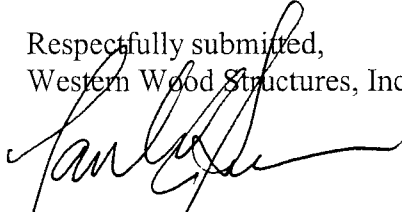
The bridges were level from side to side. Measurements were taken on both ends of each bridge and at two intermediate locations at each bridge.

There were no movements in the timber joints.

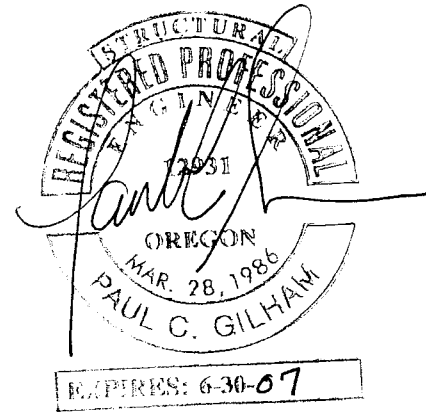
Summary

The Pin Foundation Diamond Pier foundations were examined on six timber pedestrian bridges/elevated walkway structures. On these structures observations were made to determine if foundation settlement had taken place. Observations included noting the elevation of the bridges were compared to the approach walkways, checking the bridges for level in the tranverse direction and observing the joints of the structure to determine if foundation settlement had occurred. In no instance was any indication found that suggested the Diamond Pier foundations had undergone settlements.

Respectfully submitted,
Western Wood Structures, Inc.



Paul C. Gilham, P.E.
Chief Engineer





Palouse-Clearwater Environmental Institute

To: ICC-Evaluation Service
c/o David Pereg /Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

CC: Pin Foundations Inc.
8607 58th Ave NW
Gig Harbor, WA 98332

Re: AC 336

Dear Sirs and Madams:

Please find below our performance evaluation of an installation of Diamond Piers, a product of Pin Foundations, Inc.

The piers were installed as footings for an elevated treated lumber and Trex decking structure. The structure (named Heron's Hideout by a local school child) serves as an observation deck and boardwalk between Paradise Creek and a constructed wetland. The structure receives moderate use from local residents and school groups.

The project was installed in the spring of 2003. The Diamond Piers appear to have served admirably in their foundational capacity. Close inspection in the month of September 2005 revealed no evidence of undue settling. I do not have figures regarding the levelness of the structure to begin with. Today no span of the structure is more than 2% off level.

The Moscow, ID area has relatively cool and wet winters, with an average January maximum temperature of 34.7 degrees F and a January minimum temperature of 22.5 degrees F. Average annual snowfall is 49.3 inches. Typical winter patterns include extended (2 week or more) periods of subfreezing maximum and minimum temperatures. It

freezes and subsequently thaws the majority of days from November 1 to March 30.

The area the structure lies in is a low-lying area which serves as a floodplain for Paradise Creek during very high flows. The area is damp for much of the year owing to its proximity to the stream

We are very satisfied with the Diamond Piers from Pin Foundations, Inc., and look forward to doing business with this company in the future.

Sincerely,



Jake Smulkowski
Environmental Education Specialist

 Terry A. Nettles, P.E.
Consulting Engineer
structural & residential engineering

26 September 2005

ICC – Evaluation Service
c/o David Pereg and Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

RE: AC336

Dear Sirs:

As the structural engineer who has been supporting the design, research, and product development and installations for the Pin Foundations, Inc. (PFI) proprietary foundation for the past twelve years, I wish to submit my professional opinion for the committee's consideration in their upcoming meeting. I have provided structural modeling for the purpose of load and performance analyses for the variety of the Pin Foundations products and configurations over these years and continue to consult on new project applications and specific installation issues.

Accepting the understanding of this structure/soil interaction mechanism in the performance of the "Diamond Pier" then, I would like to address the two primary issues on the table for the committee at this time. The first being that for an allowed settlement definition, and the second being that of uplift (heave) deformations resistance which might occur in a frozen soil matrix.

This system under consideration now by your committee, specifically the "Diamond Pier", I feel provides a product which is soundly based on engineering analysis and empirical evidence to date. It should be appreciated that the behavior of the foundation system is based fundamentally on the interactive characteristics of the pins (steel pipe sections) with the soil. The concrete "head" is more a device for allowing an efficient connection between the pins and the structure.

Because the "head" is made of concrete in this version of the system, it is frequently misconstrued as a bearing element because of the ease in comparing it visually with a simple truncated pyramid style precast concrete pier block. It is in fact the piles which carry all of the load to the earth. This is done through the clustering effects of the pins and their compressive, shear, and cohesion characteristics of interface with the soils matrix. We have chosen for this certification evaluation, a 1 square foot of equivalent "bearing" area merely for ease (and conservative) assignment of load capacities with those types of precast piers used with conventional construction products and for ease

of load table referencing. The fact that the loads developed by PFI in their various tests for differing soils is similar to values found in IBC Table 1804.2 makes it reasonable to assign this equivalency.

I feel that the limitations for a 0.3" settlement to accept the piers as an alternate foundation system for decks is unreasonable. IBC Section 1808.2.8.3 provides load testing methods for piles, however, it is for use "Where design compressive loads per pier or pile are greater than those permitted by Section 1808.2.10"..., which is not the case for this lightly loaded system. The 0.3" magnitude comes from that portion of the Code which was designed and intended for traditional piles (which carry substantial magnitude loads) and not for light flexible structures such as the framed porches/decks being addressed in this application. This is especially relevant for their use as foundations for an exterior deck which may be attached to the normal continuous foundations or ledger of a house of light wood frame construction.

As an example, I have provided here a common and almost universally accepted "boiler plate" specification found in nearly all geotechnical investigation reports provided to engineers and architects for the use in designing residence foundations."We estimate that settlements of footings designed and constructed as recommended will be less than 1 inch, for the anticipated load conditions, with differential settlements between comparably loaded footings of ½" inch or less. Most of the settlements can be expected to occur essentially as loads are being applied. However, disturbance of the foundation subgrade during construction could result in larger settlements than predicted."..... I have extracted this quote with the efforts to demonstrate what order of magnitude settlements is normally expected for traditional foundation systems in residential construction.

If total settlements up to an inch are viewed in the industry (profession) as tolerable for a residence, and differentials of ½" should be anticipated, then why would we want to consider placing such a severe constraint on the "Diamond" foundation system. I wish to encourage the committee to reconsider these quantitative values and recommend that a maximum of ½" settlement under full design load be used as the basis for acceptance of this unique system. Normally, the positioning of light framed exterior decks are not even considered within the scope of a standard geotechnical report. Normal precast deck piers of 8" and 12" dimensions are frequently used with no engineering analysis nor compliance with prescriptive soil bearing values nor is their placement below finished grade required.

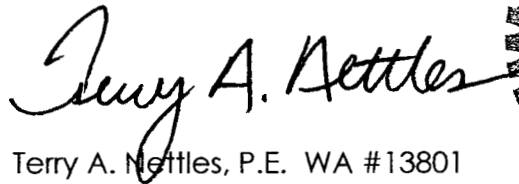
The primary purpose to attach a "Diamond Piers" supported deck to the foundation or ledger of a house would be to limit the quantity of "Diamond Piers" procured to support the deck loads where loads can be shared with the house foundations. Then because

of the flexibility of the wood framed deck, even should the "Diamond Piers" move, there is no opportunity for the deck framing and its connections to a ledger at the house to impose any extraordinary loads or deformations to the house. The house foundation or ledger will remain un-influenced by any vertical movements of "Diamond Piers".

The second issue, that of frost heave, is one which we have been addressing in prototypical installations over the past several years. It is with success and experience in the performance of installations around the country that I feel confident that this system should be considered (approved) for use in areas requiring frost protection, thereby satisfying R403.1.4.1"where otherwise protected from frost....."

I believe that the uplift constraint resistance provided by the pins driven into the soil when combined with the cleaving geometry of that portion of the diamond pier "head" that contacts the earth provides the system with positive performance in tests and in actual installations for resisting uplift deformations (heave) in severe freeze environments in which the product has been installed. The geometry of the system might be considered similar to the prow of an ice-breaking vessel in iced oceans. There is a definite wedging and splitting of the frozen soils and a similar diversion of expanding ice to prevent the lifting of the foundations.

In closing, I wish to encourage the committee's members to examine the performance behavior of this foundation system and to make judgments and decisions with an eye toward those other methods of "prescriptive" allowance which currently comprise significant portions of the International Residential Code. I believe that there is no life safety risk and any risks to long term serviceability and durability of the system are comparable to most other components found in normal residential construction.


Terry A. Nettles, P.E. WA #13801



EXPIRES: 10/06/06

D&C Construction Company, Inc.

Environmental Division

415 VFW Drive – Post Office Box 415

Rockland, Massachusetts 02370

781.871.8200

617.507.3481 fax

10 May 2005

Mr. Richard Gagliano

President

Pin Foundations Inc.

8607 58th Avenue NW

Gig Harbor, Washington 98332

RE: Commonwealth of Massachusetts Metropolitan District Commission
Upper Charles River Reservation Restoration Project
Phase 3A
Contract No. PL92-017-C3A

Dear Rick:

As you are aware we were awarded this contract in the Autumn of 2003 and found it necessary to install footings for approximately 1,500 linear feet of 12 foot wide boardwalk in the dead of winter. The thought of digging in the wetlands through 4 feet of frost and ice did nothing to enhance my mood. Under contract I was directed to install three hundred fifteen DP-100 Diamond Pin Foundations, a product which I had never seen or even heard of. When my employees first set eyes on these high tech looking items I thought every one of them was going to resign. Much to my delight, we found that installing these foundations took only a fraction of the time excavating and placing concrete would have entailed. We used a 60 pound hammer and were able to install each pin in 3 ½ to 4 feet of frost in less than fifteen minutes. Everyone, and I mean everyone, on the crew was amazed.

The following spring flood levels rose above the 100 year flood plain and a great deal of the installed boardwalk was totally under water. Here it is a year later and these pin foundations have, true to your claims, remained precisely in place with no movement what-so-ever despite the abnormally severe conditions to which they were subjected. My congratulations to you and your firm for developing a product that truly lives up to expectations. Countless hours and dollars were saved on this project due to the low cost and ease/quick installation of the piers. This is without a doubt the foundation of the future. No excavating and no placing of concrete makes for a cleaner more efficient work site with tremendous cash savings as a bonus. With Pin Foundations on the market I feel sono tube installation will go the way of carbon paper and disappear into the annals of history.

You may be interested to know that our senior carpentry foreman, who happened to be the most skeptical of the Diamond Piers, has announced that he never wants to work another job with sono tubes and has actually installed DP-50 foundations at his own home. Congratulations and thanks again.

Sincerely:



James 'Whiley' Morris
Director of Operations



United States Department of the Interior

FISH AND WILDLIFE SERVICE
911 NE 11th Avenue
Portland, Oregon 97232-4181



ABA-EN

August 30, 2005

ICC - Evaluation Services
c/o David Pereg/Brian Gerber
5360 Workman Mill Road Whittier, CA 90601

RE: AC 336

Dear Sirs:

The Division of Engineering has worked with Rick Gagliano of Pin Foundations, Inc. on projects in Oregon, Washington, California, and Hawaii from 1995 to present. Our engineers and landscape architects have specified primarily the Diamond Pier System to support boardwalks, small pedestrian bridges, and wildlife viewing structures in environmentally-sensitive areas in National wildlife Refuges.

I was personally involved with boardwalk projects at Grays Harbor National Wildlife Refuge, near Aberdeen, Washington, in 1996/1997 and at Nisqually National Wildlife Refuge, near Olympia, Washington in 1997/1998. Currently I am assisting our staff at Little Pend Oreille National Wildlife Refuge, near Colville, Washington, with a boardwalk project that crosses a small outlet to a lake and marsh.

The main advantages of the Diamond Pier System for our projects are minimal impact to our sites and ease of installation. The Grays Harbor and Nisqually projects, which are almost 10 years old, have shown no settlement or movement, and we have received no reports of foundation problems, even after the Nisqually 6.8 earthquake of 2001.

Please call me at (503) 231-6146 if you have any questions about our projects.

Sincerely,

Peter J. Weher
Supervisory Landscape Architect



United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Coeur d'Alene District Office
1808 N Third Street
Coeur d'Alene, Idaho 83814-3407
<http://www.id.blm.gov/offices/ucscd>



In Reply Refer to:
9100 (401)

SEP 13 2005

ICC-Evaluation Service
c/o David Pereg /Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

Re: AC 336

Dear Sirs:

As part of the Blackwell Island Recreation Site project, the Bureau of Land Management (BLM) constructed a ¼-mile long boardwalk across an existing wetland with three observation decks in the fall of 2003. Approximately 400 Diamond Pier Foundations were used as footings for the structure.

Coeur d'Alene, Idaho has an average of 80 inches of annual snowfall. Snow loads are 40 pounds per square foot in the area, with a maximum frost depth of 24 inches. Average temperatures during December and February range from 24°F to 48°F with a mean temperature of 31°F.

During the previous two winters, we have experienced average to below average snowfall and average winter temperatures. The BLM has not encountered any noticeable settlement or heaving of the boardwalk structure, observation decks, or the footings during the couple of years they have been in place. Overall, we are very satisfied with the product.

If you have any questions, please contact me at (208) 769-5035.

Sincerely,

William L. Perry, P.E.

cc:
Rick Gagliano, President, Pin Foundations Inc.



United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay National Wildlife Refuge Complex
Post Office Box 524
Newark, California 94560-0524

September 7, 2005

ICC-Evaluation Service
c/o David Pereg/Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

Re: AC 336

A 1200 foot boardwalk trail provides access for visitors to experience the salt marsh without damaging this fragile wetland habitat. A gently-sloping ramp joins the building to the trail, providing accessibility for those with mobility concerns. The trail then meanders across wetlands and mudflats, crossing slough channels and joining another trail.

Site: Environmental Education Center,
Don Edwards San Francisco Bay National Wildlife Refuge

Installation: Completed by December of 1999

Condition: As of September 2005, no noticeable settlement or movement as evidenced by its continued levelness. Because of the integrity of this boardwalk, it has not required maintenance over these many years. This boardwalk has allowed us to offer more education and interpretation programs into the marsh in addition to the refuge visitors using this trail.

Sincerely,

Fran McTamaney
Environmental Education Coordinator
San Francisco Bay National Wildlife Refuge Complex

*Hi Pick
your copy*

Fran



SWENSON SAY FAGÉT
A STRUCTURAL ENGINEERING CORPORATION

19 September 2005

David Pereg/ Brian Gerber
ICC – Evaluation Service
5360 Workman Mill Road
Whittier CA 90601

Dear Sirs:

Re: Pin Foundations Inc., Project # AC-336

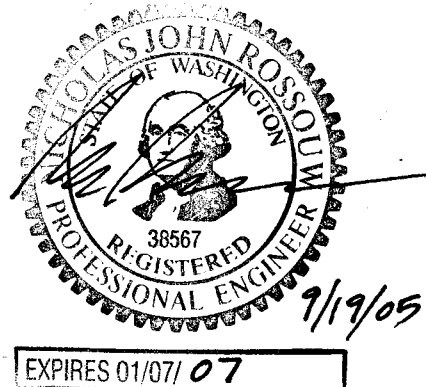
We are pleased to provide our professional support for the Pin Foundations ICC application for approval of their "Diamond Pier" foundation system. We specified their product on the Conover Commons project in Redmond Washington that was constructed in 2003. The project includes a public deck and outlook that extends over the edge of a fairly steep and environmentally sensitive ravine. The "Diamond Pier" foundation system was selected to support the deck and outlook structure because it would provide vertically and laterally stable footings on the slope for the deck. In addition the contractor and developer wanted a foundation that could be installed without disturbing the slope and with minimal impact on the vegetation.

We visited the project in the past month and it appears that the "Diamond Piers" are performing exactly as designed, two years after completion of the project. There is no detectable vertical or lateral movement of the footings and no sign of differential settlement between the footings. This appears to be an excellent engineered foundation system for this type of application.

Please call if you have any questions about this matter.

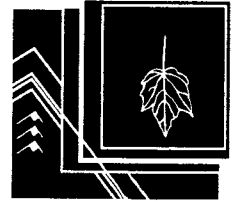
Sincerely,

Nic Rossouw, P.E.
Principal
Swenson Say Fagét



Robert W. Droll Landscape Architect, PS

ICC-Evaluation Service
c/o David Pereg /Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601



4405 7th Avenue SE, Suite 203
Lacey, WA 98503
(360) 456-3813
Fax (360) 493-2063
E-mail: bob@rwdroll.com

Re: Pin Foundations, Project #AC 336

Dear Sirs:

As a professional Landscape Architect, I have been involved with several park and recreation projects with challenging and/or unusual physical conditions. I have successfully deployed Pin Foundation products in the following projects. Typically I deploy pin foundations in wetlands, poor soils and/or with limited construction equipment access.

- East Bay Overlook**-1993-two wood overlook structures on tidal, debris laden soils-survived the Nisqually earthquake with no damage/subsidence.
- Chehalis Western Trail Overlook**-1997-wood overlook on peat/muck soils, when under construction, a doctorate of engineering asserted the pin foundations would not be sufficient to with the overlook's load, to date, no apparent subsidence, structure level and plumb.
- Wildwood Park**, 2003, wood stairway on 3:1 slope covering 40 vertical feet, looks great today
- Kennedy Creek Salmon Trail**, 2000, wood overlooks, looks great today.

Pin Foundations offers unique product that have performed well over time; I continue to deploy the product when the opportunity arises.

Thank


Robert W. Droll, ASLA
Principal



ICC-Evaluation Service
c/o David Pereg /Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

Re: AC 336

Dear Sirs:

North Wind, Inc. recently completed repairs to a nature trail/boardwalk for Hurlburt Field Air Force Base in Mary Esther, Florida using Pin Foundation Inc., 100# Diamond Piers as foundations for the boardwalk. Diamond Piers were selected as the foundation of choice for the boardwalk because of their stability and their unobtrusiveness to the native soil, as the project is located in both wetlands and a historic archaeological area.

The previously existing boardwalk had sustained major damage from Hurricane Ivan, which struck the Gulf Coast in September 2004 approximately 70 miles west of Hurlburt Field with maximum winds at 86 mph and tidal surges of 6-9 feet.

The project was completed and accepted by government personnel on 11 May 2005. Two months later, on 10 July 2005, Hurricane Dennis made landfall approximately 15 miles to the west of Hurlburt Field. As reported by the National Weather Service, maximum winds at Mary Esther, Florida were 102 mph and the tidal surge was 5 feet, which completely submerged the boardwalk. Upon inspection of the boardwalk after Hurricane Dennis, it was found that not a single Diamond Pier had been compromised and the boardwalk maintained its levelness and sturdiness even though a section of the boardwalk had been repeatedly rammed with a 26' sailboat that had become unmoored and washed ashore.

On 29 August 2005, Hurricane Katrina came ashore on the Gulf Coast in the New Orleans area, approximately 250 miles from Hurlburt Field, and produced local wind speeds in excess of 60 miles per hour and tidal surges of 3-5 feet. The boardwalk, anchored by the Diamond Piers, again held up without compromise to the integrity of the structure although it was again inundated with water and again battered by the above mentioned sailboat.

Based on the amount of destruction caused to the boardwalk during Hurricane Ivan and the lack of destruction caused to the boardwalk during Hurricanes Dennis and Katrina, it is safe to say that the Diamond Piers acted as a major stabilizing factor in the construction of the boardwalk.

Sincerely

Taj Goodpaster
Construction Project Manager
North Wind, Inc.

ICC-Evaluation Service
c/o David Pereg /Brian Gerber
5360 Workman Mill Road
Whittier, CA 90601

Re: AC 336

Dear Sirs:

I am writing you in reference to Project #AC 336
International Code Council Evaluation of the Diamond Pier Foundation System.

I have used both the Pin and L.I.F.T. foundation systems for two houses that I built in Conroe, TX. The first house is my own. Lone Star Testing Laboratories performed the soil test and James L Hickey, PE, Registration No. 30518 in the state of Texas sealed the results. The soil consisted of stiff to hard sandy clay for the first eight feet followed by a three-foot deep layer of expansive silty clay. We began construction in August of 2003. My house is approximately 3100 sq. ft. divided between a 2400 sq. ft. first floor and a 700sq. ft. loft over the back half of the house. The L.I.F.T. portion of the foundation is at concrete stem wall 18" high with pin inserts located as required for loading. Each insert held two 5'-0" long pin piles. Anchored to the concrete wall is a 2 x 6 treated stud pony wall 2'-6" tall which put the first floor at 4'-0" above grade. Six diamond piers support the front of the porch floor and house roof that wrap the southeast corner. Each diamond pier holds four 3'-6" long pin piles and carries a load of 5400 pounds. The porch floor supports on the back attach directly to the exterior wall of the house and the roof of the house extends over the porch so any differential settlement of the two systems would be immediately visible from the exterior of the house. Construction of the house was complete in January of 2004 and there has been no noticeable settlement or cracking of either system. Using these systems enable me to save money by using less concrete and less fill material and its negligible environmental impact allowed me to save many old growth trees that normally would have been removed.

The system was so successful that I constructed a second house for a client in the same neighborhood development. The soil testing was by Lone Star Testing Laboratories and showed the same results. Construction began in August of 2004 and was complete by July of 2005 the same combination of Pin and L.I.F.T. foundation systems with a treated wood pony wall was used. The second house is approximately 2100sq. ft. on one level with a much larger porch that wrapped the southeast corner and extended across the southern facade of the house. Nine diamond piers support the front of the porch floor and house roof. The floor supports of the porch on the backside are directly connected to the exterior wall of the house and the roof of the house extends over the porch. There has been no noticeable settlement or cracking of these foundations and again many old growth trees that would have been removed to construct a traditional foundation were saved with this system. I feel these foundation systems are much safer than a traditional pier and beam or perimeter beam system and causes less damage to the surrounding wildlife and natural drainage than a traditional slab on grade foundation system. I plan on using these systems again and I would recommend the use of this system in this region

specifically because of the soil types, the presents of a high water table and the tendency to flood, the location of several water sheds and recharge zones near by and the need to maintain the existing environment for forest and wildlife health.

All soil test reports are available upon request and both structures are available for inspection. If you would like to speak to me about the information or opinions stated above, please feel free to contact me at the address or numbers noted below.

Sincerely,

A handwritten signature in black ink that reads "Jane E. Baughman". The signature is written in a cursive, flowing style.

Jane Baughman, AIA, LEED-AP

Associate

FKP, Inc. Architects

8 Greenway Plaza, Suite 300

Houston, TX. 77046-0899

Ph: 713.621.2100

Fx: 713.621.2178

jbaughman@fkp.com

CC:

Rick Gagliano

Pin Foundations Inc.

8607 58th Ave NW

Gig Harbor, WA 98332