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Portland Cement Vs Historic Gravestones

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Jonathan Appell: Apparently, The Pyramid of the Sun in Mexico looked like this before 1910. News story out now ... I'll just go through these images quickly, is this Mr. Menchaca just did a study based on some very high tech sub-atomic particles, and apparently it took him many years to get approval, and then ten years to build to the machine to do this. He determined the fact that ... Here he is right here, a nuclear physicist, that The Pyramid Of The Sun is in danger of collapsing, according to him because of Portland cement concrete.



Portland Cement versus Historic Gravestones.

I'm staying on topic here. This wasn't just a really random thing. Yeah, so anyway in about 1910 ... They did soundings. They can do much deeper with this type of detection device that's really cutting edge technology, and they determined that on the sunny side ... Most of this presentation will be all images. On the sunny side, here's the restoration from 1910 that was done then.

What they did is they dug away a bunch of dirt and put in a whole bunch of concrete. On the sunny side what has happened, that it's dried out because there's no vapor transmission. The end result is the recommendation to create vapor transmission, is to dig it back up again and remove the concrete.

It's a dirt pyramid. It's packed, it's earthen. The point being that Portland cement based concretes were the next best thing since sliced bread, so here we go. They were invented in ... Portland cement was invented by 1824, but it didn't really come into widespread use ... This is from preservation briefs too for anyone who doesn't know. A great resource for knowledge. It's on the Internet. This preservation brief two is about historic pointing which is directly related to cements. There's not going to be many images like this, but this is what Portland cement can do to historic brick. I'm preaching to the choir here, as Joe mentioned before to the large degree, but we have people of different knowledge bases here. Anyway, here we go.

Okay. What we run into a lot in graveyards is the most common thing is tablet stones that are snapped and repaired by puddling them into concrete, and it makes them very hard to rework them. I'm just going to go through some images of things, and then some solutions as well.

You can see concrete on one side. This is in Trinity Churchyard in New York City, in Manhattan. That is concrete, three stones. They formed it and it's above ground, but it's still three stones put into one mass of concrete. This is in Hampton, New Hampshire. They get carried away. If you can do a couple why not do a whole cemetery. This is in South Salem, New York; just a couple good close-ups here. This is something that I worked on.



Problems with concrete cast around historic stones.

What you'll find often sometimes, is they actually cap the existing bases. I have some latter pictures of that as well, but you can see here the ... Let me see if I can work this, okay there we go. You can see what happens when you embed this marble around the concrete is that it's pretty, really crumbling. Just disintegrating like granular disintegration, sugaring. That's what will tend to happen if you combine these unlike materials.

Here's a sequence of shots. This is in Enfield, Connecticut. This is exactly how I found this. Just like these two shots indicate. Just a typical broken two inch tablet, slab stock. You'll see that all over America. A little bit of excavation; better to get under the foundation if you can, but when you're way underground that can be very problematic. Then I was able to lift this massive concrete along with the lower portion of the tablet, and here it is repaired but not cleaned. The snow came before I had a chance to do that.

Then neat cement is a cement mortar, grout or glue that's made without the addition of sand or lime. Just straight up Portland cement. If you want something really strong, impossible to ever get off a material and rework, and completely incompatible in any softer material, it's a great choice.

Here we have a stone that's out on Cape Cod in a town Eastham. This was on a brownstone, maybe a Connecticut brownstone, I'm not sure, but they used it as a ... Actually a glue and an infill material. Needless to say, it failed. In that situation oftentimes you just have to leave it. Unless you want to grind it off because chiseling it off assuredly will take a lot of stone with it, and it may just destroy it. As they will say in medicine, you could destroy the cancer and kill the patient. You got to use your judgment a lot.

Here we have ... This goes back to Irving's images from Massachusetts. We have when they would form something like this. Sometimes they would do this in a stone and inset it into a granite, and really that's a high-end repair, but this is more common. When they do it, just puddle it right in on the flat so they can stand it up. I mean, at least they saved the stone and oftentimes the pieces will disappear if they didn't do something. These things are historic.



Historic marble marker laid in concrete.

This was in Woonsocket, Mass. and these people in the front row were at the site with me. This is a great one here. This is at the same site. This is exactly how this object was found. It's hard to tell what's really going on here. There's definitely a previous repair. We can see the base. This is the lower base. It's I believe a granite base. It's a marble headstone. First thing to do is excavate. It was embedded in concrete on the flat. Fortunately what we hoped for is that they were as slap dash about their concrete work, and so they made weak concrete because they didn't use a lot of Portland cement and/or didn't do any prep so there was a lot of dirt on the stone and then it might not adhere well.

The thing about this was that I was missing a middle base here. The lower base was good. I raised it up and leveled it, but there was an upper base or some people will call it a mid-base or occasionally a plinth block. The names are blurred. Anyway, here was the entrance to the cemetery and I kept walking in and out, and then it occurred to me the step here that I kept walking over looked suspiciously a lot like the missing base. In fact, I measured it and it was the missing base. Either that or a dead ringer.

Interesting to note here that the carvers name is on here but it's upside down. I spent a little bit of time trying to get this out, and it was absolutely fully embedded. On the back end it was just puddled all the way, actually coming over the top. I mean, the way to get something like this apart if you really had to, would be to just drill a hole bunch of holes around it probably and get under it. I mean you could spend a half a day and you might still damage it badly.

It was decided to ... Well there it is. There's a close-up of the carver, for anyone who knows carver ... People don't study the carvers that much in the Victorian Era as they did in the Colonial Era but nonetheless, more like a monument company. Then what I did was I casted a replacement, out of Portland cement, but I didn't puddle it into it. I created a socket and then set it into it with a historic pointing mortar. Then after the loss was filled ... Also, it had to be broken apart and then that Portland cement up here had to be chiseled away.

This is a stone I encountered. I didn't work on this one, but this is one I encountered in Deadwood, South Dakota. It was a really hilly cemetery there. I really like their solution. They obviously didn't have a bar or no ... They didn't attend my seminar on leverage. They decided that they would just add some Portland cement, but they were nice enough to date it so that at least we know the age of this workmanship.

We have a pretty cool pattern on the lower base, and then it's probably ... All over the country in a lot of areas they'll use a different material for the lower base as they will for the mid-

base. This would be like a gray marble, and the lower base here I don't recall. It looks like a white marble, but I'm not really sure what it was.

I tried to represent the country here because we're missing a lot of attendants from places, so I'll at least show their images. This is in Coos Bay, Oregon. I was told in Oregon you got to think of an ore and a gun. You don't say Ore a gon or they know you're not from Oregon and they might get out their gun, so you ore and a gun, ore and a gun.

Anyway, a little bit of Portland cement here. You'll see this in a lot of areas out west when they make trellising and they do all kinds of landscape work with Portland cement. It's not just limited to stone repair. This stone was important to this ... I did a workshop out there about five years ago, but this family hired me to work on, to fix this one monument. It was their family monument.

What I found out is that, well this is this giant mass. It's a whole ... Well you can see. It's a giant piece of concrete. What I decided to do is shim this up and then build this up with historic pointing mortar so that this upper base here would be level in all dimensions, so that I could then set the upper component onto it. The lower base obviously was unchanged because it's fully embedded into concrete. Here it is after, and I think I did infill work, but I didn't have that image handy.

Here's another one. This is back ... I just showed some earlier shots. This is Ring Swamp Cemetery in Hampton, New Hampshire. They did something pretty cool here. They decided that even if the stones were in good condition, that they would cover all the bases and stuff with concrete anyway just for fun. Luckily it was like I said, poor quality concrete, and also it had a lot of rock in it.



Examples of Common Problems Caused by Hard Cement based Repairs Puddling into wet concrete.

I found that after experimenting that I could actually just break it away without damaging the stone if I was careful. You can see there was a little chippage here, but pretty much it broke away, but the interesting thing is that there was no reason for it in the first place. It had a full base on it and it wasn't even broken. It's like, what are they thinking? It's hard to know.

Here's another one. Yeah, same cemetery. You can see the concrete collar technique. Big chunks of ... It's a batch mix and then big chunks or rocks, gravel mixed in. That's why it was able to be broken away as well as it was. I found that it was actually much safer. In the case of stones like this, what I could do is just cartwheel them out of the hole first, and then to get this off, a lot of times it's better to hit it up into the mass of it because it's much less likely you'll break off the bottom because there's more surface area up here and it's much stronger that way, so that's what I did. There's some of my workmanship. The town was nice enough to

take that away from me. There's the same stone after it was leveled. There was never anything wrong with it in the first place before the concrete.

This is in Richmond, Kentucky. This is a monument for Cassius Clay. Cassius Clay was actually a guy who was in Abraham Lincoln's administration, and Cassius Clay the boxer's father, was named after this guy. I worked on this monument, and I threw this in. This is a Kentucky limestone base. Really bad erosion, and I actually restored this whole base. You can see the way they capped it with a hard Portland cement, which only created more problems and trapped moisture. I just threw this one image of that in.

I rolled through these pretty quick. Now I have a series here on this one job, so I showed the entrance of this nice little cemetery. I got hired to go fix this one stone. I travel all over obviously. This wasn't that far, but still when you're going a couple hours or whatever you don't want to have to go back if it's a small job because it's a one day job. If I go back, then it's a two day job. That's not a good thing. You know?



Lifting a broken marble marker cast in concrete

I get there and I see this. Well of course it's in Portland cement. What else is new? Everything's in Portland cement. I'm like, "Okay that's all right." I have a lot of ability to move things. My first thing is what I'm going to do. I see this, I'm like I'm going to pry this thing out of the ground. Where this concrete is connected to I'm going to make a new, cast a new base, just underground with a socket, and then I'm going to reset this thing.

Well then I started digging, and what I find is it goes straight to the center of the Earth. This thing, I'm not joking. I had an eight foot bar with me, and I couldn't move it at all. I mean it didn't move. There was no movement. I mean you could move a few thousand pounds with this bar and it wasn't moving. I really, I don't know. I never saw the bottom of it.

I decided that I wasn't going to move it, so I broke away that top piece of the tablet. Just to back up a little, you can't join something to this. There's too much loss, it's really sugary, it's all broken down. You can see what happen actually, when you smack it with the hammer it just breaks up and it just turns into powder, a lot of it because it has no strength.

Then what I did is I made a form ... I thought I had a picture of it, and somehow I missed one. Yeah that's okay. I built a form and I had enough stuff with me to do this. I always have all cordless tools and everything. I was short, so that's why there's a scab here holding two pieces together. I had just enough material with me to get this thing built. What you see in the center here is that, that is foam. High density rigid foam, like Styrofoam installation, two inch thick.

I put this obviously, right on top, but then in order to do this I also had to make sure, because this is a finished thing now, it's got to be right in line with the row. There is an existing row there. Then also it has to be leveled in both directions pretty close. I mean I'm still, I have some room to leeway because of the socket and when you set it, but it's got to be really close or it's not going to look good when it's done.

Then it was broken at an angle, and depending ... I mean if it's just a little bit you can just shim it up a little, but it's better to square it off. Again, I use cordless tools a lot, and so I scored it and then I cut it with a diamond blade on a grinder. This is showing the whole process. There's the fresh cut that's nice and square. Then I tore the foam out. Remember this is all one day. You've got to use fast set concrete.

You can see it's a little rough on the edges because I tore it out so fast. I tore it out in about an hour, and also, usually I'll breakdown the form first. It's all screwed together so it all comes apart, but because the concrete was so green, even with fast set. I left the boards in longer so I pulled the center first. Then I put historic pointing mortar in. Then I set the stone, then used the stakes as temporary support. Then there it is all set. You can see the light is pretty low. I basically used most of the day.

I always have a couple of rechargeable battery powered flashlights with me. More than once it's been even darker than this. That's it. I went through them quick.

Abstract:

The precise historical origins of Portland Cement are very complex and beyond the scope of this abstract, however its beginnings can be traced back into the late 1700s. It was not until 1878, that a standard on Portland cement was issued by the Association of German Cement Manufacturers. In the following two decades, to the turn of the 19th century, increasingly large quantities of Portland Cement were imported into America at an exponential rate.

It became the next best thing since "sliced bread" in the construction industry.

Portland Cement hardened much more quickly than lime based materials, from hydration rather than carbonation, becoming extremely dense in a short time span. It quickly became the material of choice for not only new construction, but also in many forms of "restoration" work. Little was known about its longevity and even less was about its future reversibility, a term not yet even invented in the emerging fields of historic preservation and object conservation.

It was not until quite recently, over the last few decades that gravestone conservation has become an accepted scientific field of study, fostering events like this Cemetery Preservation Summit. Even today, the majority of historic memorials, which are repaired, are not conserved by individuals with adequate training throughout most of America.

Of all the possible gravestone conservation challenges that can be encountered, the one that can be feared the most is gravestone and cemetery monuments that have been previously repaired with a hard Portland Cement based mortar and or concrete.

The most common type of gravestone to fracture, are the thin marble slab style stones, commonly only about 2 inches in thickness. Even when new, this narrow thickness created a very weak material design, but once weathered and or leaning they are easily snapped off at or above grade. By far the quickest and most common repair performed in this situation is to simply "puddle" or stick the broken stone into a crude liquid concrete, prop it up and let it harden.

Unfortunately, gravestones that were repaired in this matter often end up being re-broken again from storm damage, lawn mowers, etc. The soft marble meeting the very hard Portland Cement concrete also creates a weak point, where these incompatible materials meet. Additionally the transmission of salts and other chemical interactions can contribute to the weakness.

Large gravestones and multiple piece monuments are also not immune to the misused Portland Cement disease. Leaning monuments are often straightened and then finished off, with a band of concrete around the entire lower base. Sometimes, even new monument installations were simply placed into a wet concrete mass. If these monuments end up leaning and or toppling the concrete can make there resetting extremely difficult.

Finally, Portland Cement also make an extremely strong mortar, grout or glue. One that is nearly impossible to ever remove from a softer stone such as marble, sandstone or slate. Therefore, if past repairs were performed with a very hard mortar they can make re-working and repairing the stones a second time an almost impossible nightmare.

This presentation is based on stones that I have encountered with this Portland Cement Disease from all over America. I will offer many varying solutions that I have formulated, to solve this very difficult conservation challenge.

Speaker Bio

Jonathan Appell is a professional masonry conservation specialist with expertise in gravestone, monument, sculpture and historic masonry preservation. Trained in engineering, violin and cabinet making, sculpture and stone carving, Jonathan has worked in fields related to historic masonry for over 25 years.

In 1986 he founded the New England Cemetery Service, performing excavation, foundations, monument installation and monument restoration. Since 1999 he has worked exclusively on historic masonry, historic monuments, gravestones, training workshops and preservation planning.

Jonathan is a member of many organizations including, APTI, AGS, AIC, and currently a board member of the Preservation Trades Network. He owns a large library of books on geology, conservation, stone working, rigging, gravestones, etc.

Over the past ten years, Jonathan has lectured and conducted preservation workshops throughout the United States and Canada. He has performed preservation projects on some of the oldest colonial tombs and gravestones in North America. More information can be found in his websites, www.gravestonepreservation.info & www.gravestoneconservation.com

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