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CELL-CRETE CORPORATION

ENGINEERED FILL

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ENGINEERED FILL

Re: Cellular Concrete as Engineered Fill

I'm pleased to report that cellular concrete Engineered Fill has continued to grow in acceptance with proven results by both public agencies and the private sector. The increased acceptance is due to tireless product research and development by the Elastizell Corporation and the entire cellular concrete industry. The many varied and successful applications installed by the Cell-Crete Corporation provide confidence with our clients. We are seeing increasing confidence from Geotechnical engineers, agencies, consultants, contractors, owners and designers in this game-changing product.

ELASTIZELL EF is specialized cellular concrete formulated specifically by the Elastizell Corporation of America for Geotechnical applications. It is often used in difficult situations where either the standard fill materials are too heavy or alternate solutions are too costly and time consuming as demonstrated through project specific value engineering.

The various applications of ELASTIZELL EF are as broad as the designer's imagination. Below are the most common applications of this material, which may weigh as low as 18 pounds per cubic foot (pcf), more commonly around 25-30 pcf. It is 10X stronger than most soil and dirt fill materials.

1. **Reduces dead loads on a structure** due to it high strength and low density while maintaining or increasing accompanying elevations. This is especially important with older structures when new uses are contemplated. This may save the difficult and costly strengthening of existing buildings, bridges, or specialized structures such as culverts, retaining walls and plaza fills.

2. **Place it over poor soils at a bridge approach or grade separation.** The most common application, where the ELASTIZEL EF thickness at the abutment may vary from less than 5 feet to often more than 20 feet. Different densities may be required in various locations of the approach fill to satisfy specific requirements.

3. **Eliminates Surcharging**. With a properly load balanced application of Elastizell EF there is no longer the cost or delay of surcharging to stabilize deep soft soils or bay mud.

4. **Roadway base fill** for rehabilitating an existing roadway or for the construction of a new road over a poor subgrade. When maintaining an existing road, the additional weight of roadway leveling patches will often further consolidate the soil leading to additional differential subsidence. For these, as well as new roadway sites over poor soils, ELASTIZELL EF provides a solid, yet lightweight roadway base, which reduces further settlements and will span most differential subgrade movement. Water in an Elastizell subgrade does not cause settlement!

5. **Ideal for void fill applications** because of its lightweight flowability, ease of placement, cementitious properties and no need for compaction! These applications may include abandonment fills, annular fills for sliplined pipes, fills between both a pipe and a tunnel cut as well as a pipe and a cribbed excavation. Other void fill applications may be sink holes, swimming pools, voids under slabs, and voids created by washouts.

6. **Slab and footing pad fills** of ELASTIZEL EF will spread loads over larger areas as well as reduce the weight of these supporting structures. These are important considerations over poor soils and can often replace more costly alternatives such as pilings, caissons, micropiles, surcharging, etc.

7. **Eliminates lateral loading on retaining walls.** Once ELASTIZELL EF sets, it does not apply lateral pressure. Depending on its shape and location, the ELASTIZELL EF may be designed to reduce or eliminate lateral soil pressures. This may result in substantial savings in the design and construction of new structures or the remodeling of existing structures.

ELASTIZELL EF may be the most timely and cost efficient solution for your geotechnical problem. Please call to discuss your application, its technical design, and the costs of a Cellular Concrete solution.

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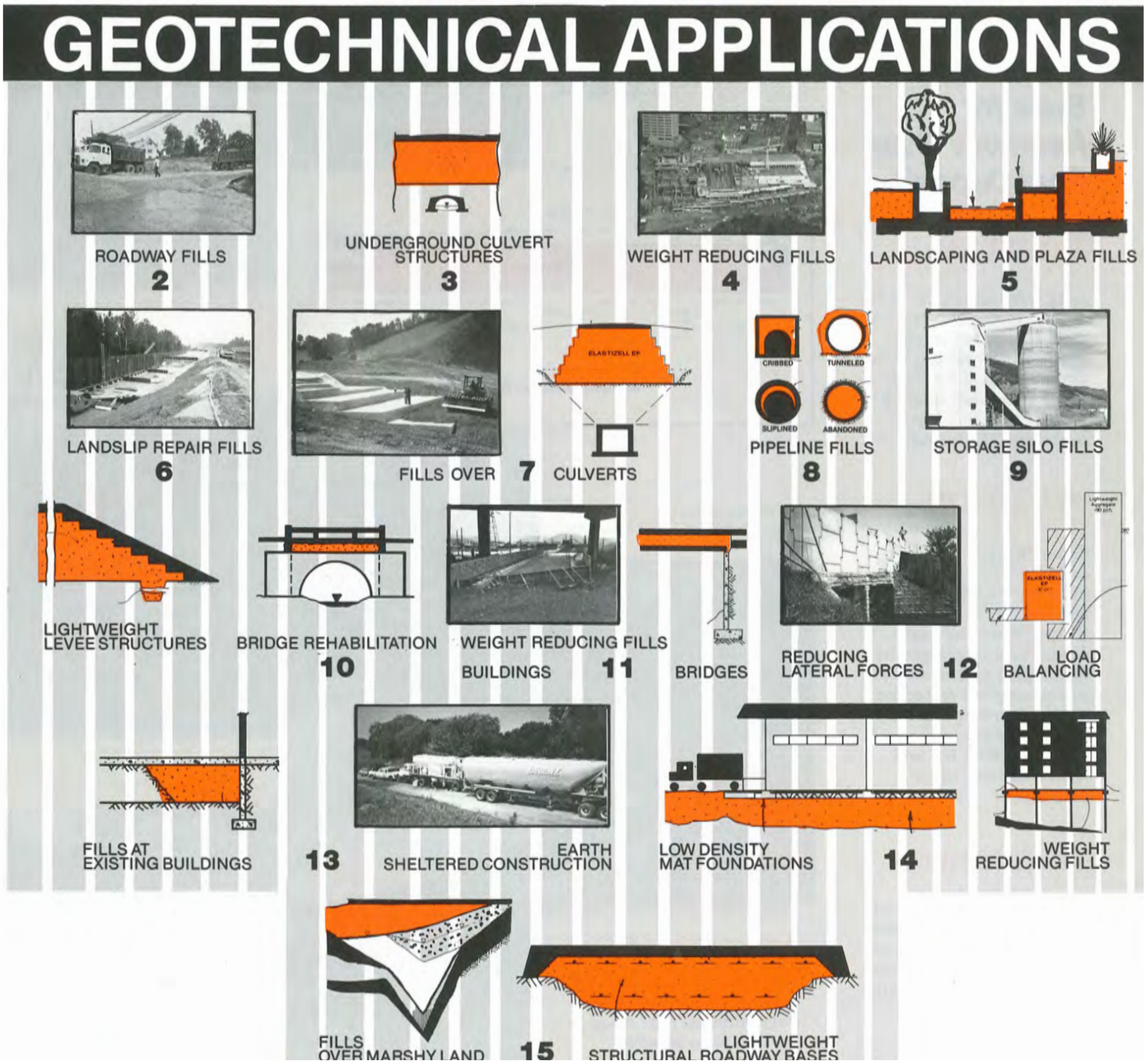
CELL-CRETE (Engineered Fill)



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ROADWAY FILLS

Elastizell EF Serves as Base for Roadway Over Peat Deposit.

Bay Bridge approach slab being replaced while traffic is maintained on the other side.

PROBLEM

Long term settlement of an asphalt roadway over a peat deposit required regular maintenance. Adding more asphalt to level the roadway was a temporary solution which caused additional settlement of the peat.

SOLUTION

Removing the very thick asphalt roadway section and installing **ELASTIZELL EF** will unload the peat by about 160 psf. Since the peat deposit was surcharged by the original asphalt roadway and subsequent corrective layers of asphalt, the much lighter roadway subbase of **ELASTIZELL EF** will reduce this settlement problem.

DISCUSSION

Because of the high cost of land, marginal land is often all that remains for highway construction. This land may be either a sanitary landfill or soil with a very low bearing capacity.

In the pictures, **ELASTIZELL EF** was cast over partially excavated peat to reduce the load of the fill, to distribute the highway loading, and to provide a solid base for the compacted fill and flexible asphalt pavement.

West County Connector

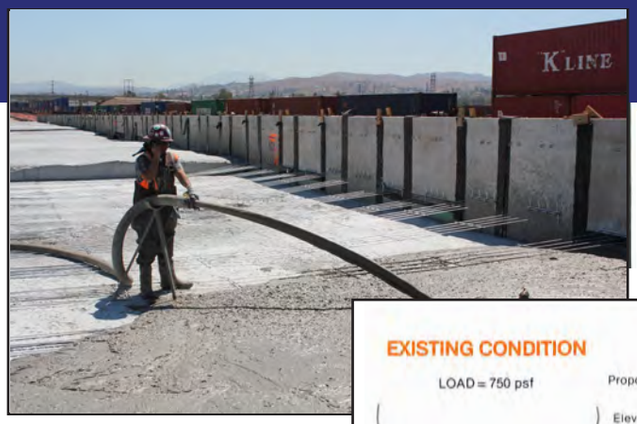
San Bruno Grade Separation

A view along the roadway reconstruction showing depth of cut, **ELASTIZELL EF**, aggregate road surface, and temporary traffic barriers.

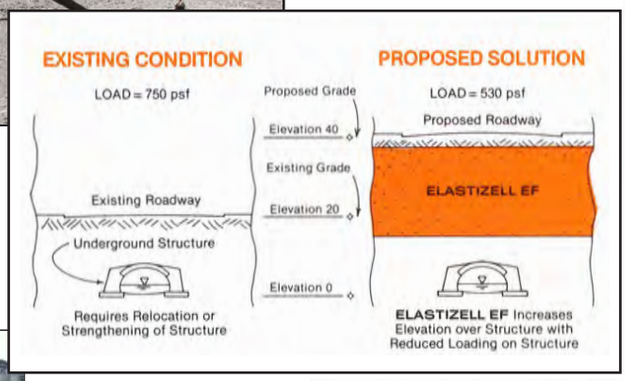
ADVANTAGES

- **ELASTIZELL EF** *is the only material that could be used for a solution such as this.*
- *Halts a costly and continuing maintenance problem.*
- *Since it is pumped into place and does not require compaction,* **ELASTIZELL EF** *may be placed efficiently in urban areas while maintaining traffic.*
- *Provides a safer roadway by eliminating the "roller coaster" effect.*

UNDERGROUND CULVERT STRUCTURES



Roadway base over existing Transit Tunnel



Elastizell EF Reduces Loading Over an Underground Culvert Structure Unable to Support Additional Loads.

Tight construction conditions with Heavy and Light Rail

PROBLEM

A roadway grade must be raised to accommodate a new transit system. A portion of the roadway is over an underground culvert structure unable to carry additional loads. How can the increased elevation be achieved at a minimal cost without overloading this structure?

DISCUSSION

The major concern in this application is what happens to the culvert structure when it is unloaded (by removal of the existing soil) and then slowly reloaded to 2/3 of the original load (when the **ELASTIZELL EF** is cast).

The resulting **ELASTIZELL EF** approach is much less costly and less time consuming than special underground foundation and structure work designed to carry the additional loads of a heavier fill.

SOLUTION

In order to increase the overall depth of fill over the underground culvert structure, it is necessary to first remove a portion of the existing soil. In this case, it was decided to remove the existing soil down to just above the ground water table. The existing soil removed averaged 8 feet in depth.

Then Class II **ELASTIZELL EF** is cast in thicknesses ranging from 8 feet to 23 feet along the 600 foot length of the problem area. After the 23 foot thickness of the **ELASTIZELL EF** is placed, the load on the culvert structure is only about 2/3 of the original load from the original 8 feet of soil.

The new roadway can then be placed on the **ELASTIZELL EF**.

ADVANTAGES

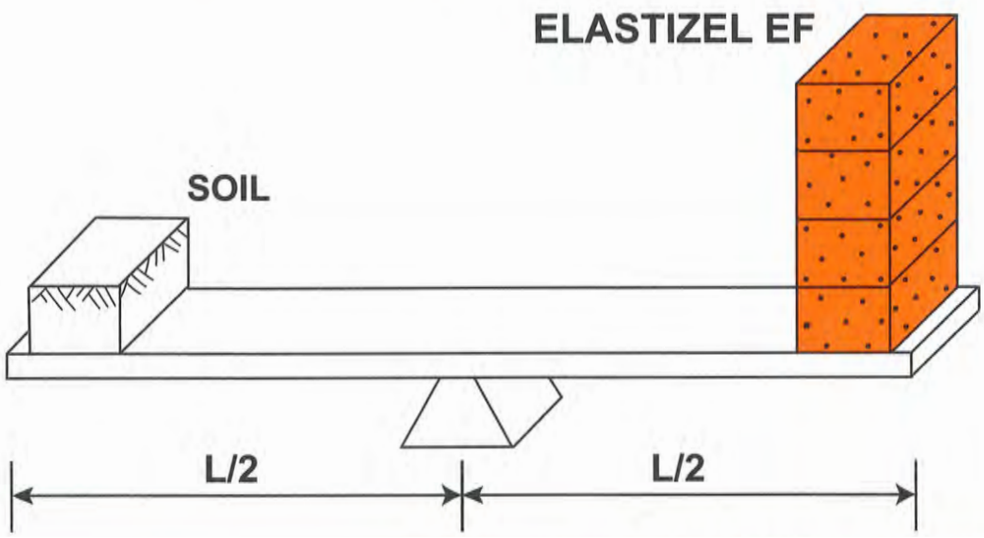
- ***The simplest solution is a load reducing* ELASTIZELL EF.**
- ***Alternate solutions would have a high probability of damaging the underground structure.***
- ***The very lightweight, stabilized* ELASTIZELL EF *(25 pcf) permits about a 4:1 ratio of fill depth increase to existing fill removal.***
- ***If this culvert section were to be diverted, reconstructed and then reconnected, delays of 1 to 2 years and excess costs of millions of dollars would result.***

Specialized and certified equipment is required for these large CELL-CRETE installations.

ELASTIZELL EF (Engineered Fill)

RESEARCH REPORT

Load Balancing & Load Reduction



Comparison of Fill Material Densities

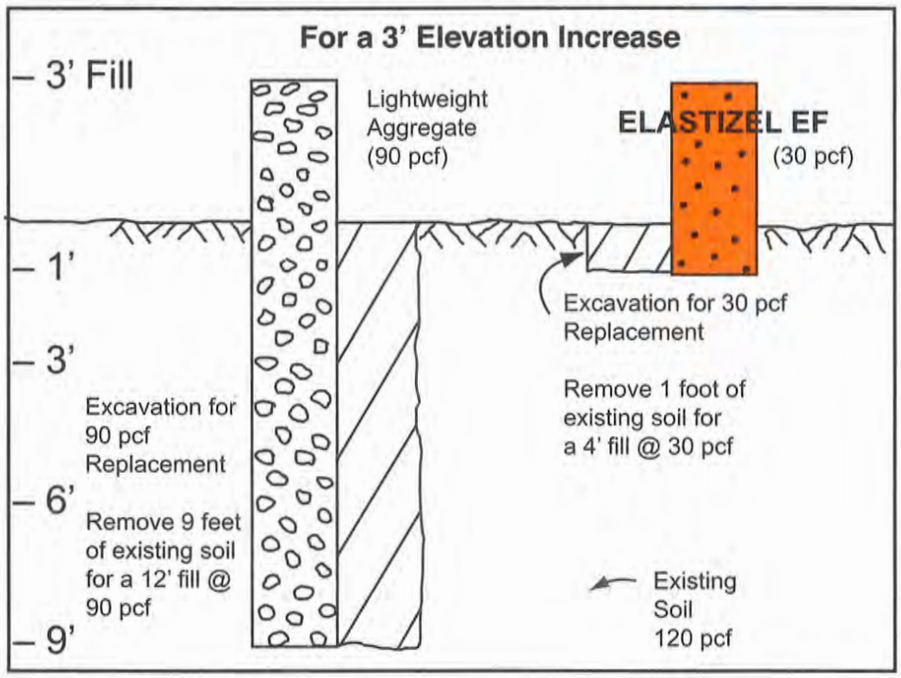
CAUTION: For products that may appear similar, demand material test data, in-place performance documentation, and a certified applicator with experienced personnel using approved equipment.

ELASTIZELL EF	
Class I	18 – 24 pcf
Class II	24 – 30 pcf
Class III	30 – 36 pcf
Class IV	36 – 42 pcf
Water	**62.4 pcf**
Lightweight Aggregates	**60 – 90 pcf**
Soils	**120 pcf**
Aggregates	**125 pcf**
Lean Concrete	**145 pcf**

LOAD RELIEF COMPARISON

Load Balancing and Load Reduction concepts involve removing a specific depth of existing heavy material such as soil or part of a structure and replacing it with an equal or greater depth of **Elastizell EF.** The **Elastizell EF** places less load on the existing soil or structure even though the new fill depth is significantly greater than the original fill. This concept is utilized for both new construction as well as for rehabilitation applications. These may be applied on existing marginal ground conditions such as peat areas or deep poor soils overlain with better material. In addition, older structures such as bridges, abutments, retaining walls, culverts, etc. may have reduced loading on them utilizing **Elastizell EF.**

ELASTIZELL EF vs. Lightweight Aggregate

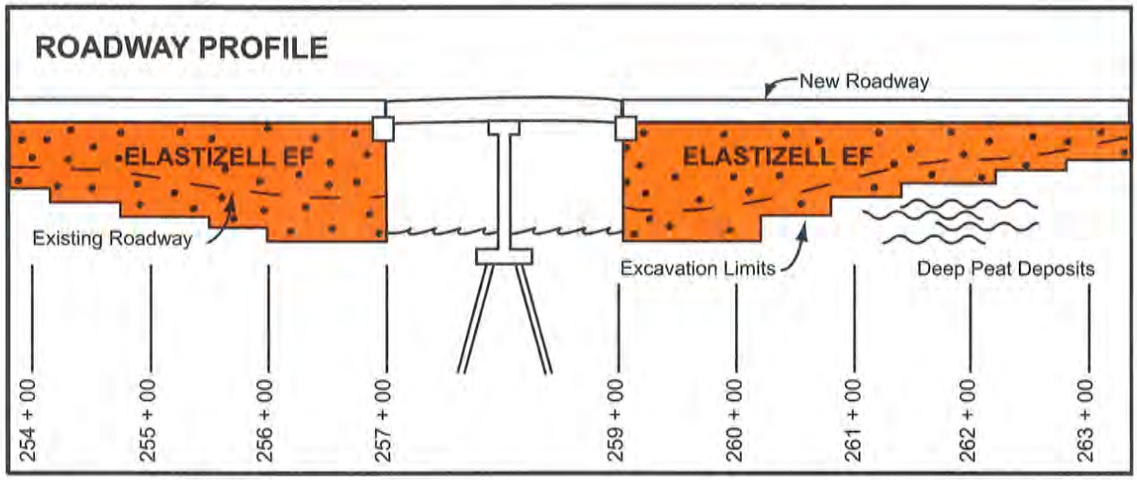


	Elastizell EF	vs. Lightweight Aggregate
Excavate	1 unit	9 units
Replace	4 units	12 units
Compaction	not required	required
Compaction in Restricted Areas	not necessary	impossible

ROADWAY CONSTRUCTION

In roadway construction (or reconstruction), **Elastizell EF** is an effective method for raising roadway grades over marginal surface soils as well as deep deposits of poor material overlain by fairly good soil. Load balancing reduces normal roadway loadings for equal or greater final elevations.

In the sample below, it is required to raise the roadway elevation about 10+ feet since it is located in a flood plain. It will be necessary to balance the added load and subsequent settlements with the buoyant uplift forces at the 100 year flood level. A computer analysis simplifies this calculation and aids in the selection of the optimum solution. Stepped **Elastizell EF** controls the dead weight, volume and cost of this renovation.

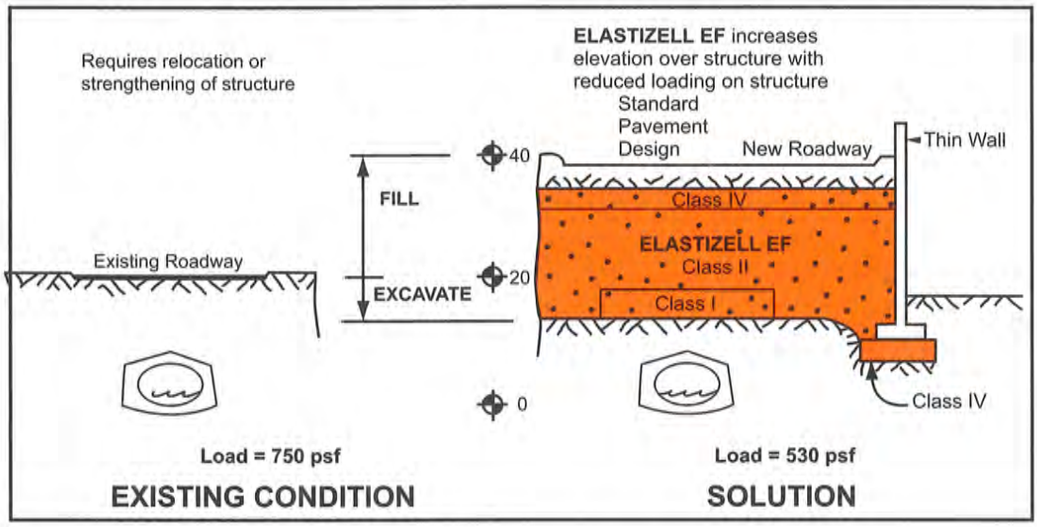


LOAD BALANCING ANALYSIS

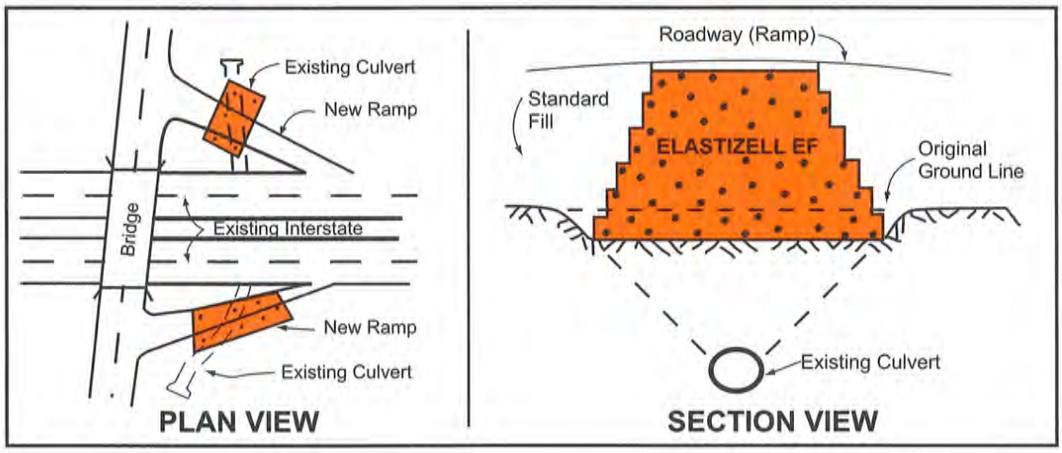
Station	Final Elevation	Existing Elevation	Elevation Difference	Excavation Thickness Under Pavement	NEWLOAD: Remove Pavement As Req'd AsBack 35	Buoyant: Required Base As Req'd AsBack 35	Excavation Thickness Under Pavement	NEWLOAD: Remove Pavement As Req'd AdBack 35	Buoyant: Required Base As Req'd AsBack 35
254+00	992.20	985.29	6.91	1.5	301	2.2	1.5	301	2.2
+50	992.35	984.70	7.65	1.0	379	2.2	1.5	348	2.4
255+00	992.50	983.59	8.91	1.5	427	2.8	2.5	365	3.1
+50	992.65	981.30	11.35	1.5	581	3.5	1.5	581	3.5
256+00	992.80	980.03	12.77	1.0	702	3.8	1.0	702	3.8
+50	992.95	980.15	12.80	1.0	703	3.8	1.0	703	3.8
257+00	993.10	980.82	12.28	2.0	609	4.0	2.0	609	4.0
+20	993.20	981.25	11.95	2.0	588	3.9	2.0	588	3.9
258+00	Bridge	River	0.00	0.0	0	0.0	0.0	0	0.0
+45	993.25	983.50	9.75	2.0	449	3.2	2.0	449	3.2
259+00	993.10	982.18	10.92	2.0	523	3.6	2.0	523	3.6
+50	992.95	981.90	11.05	2.0	531	3.6	2.0	531	3.6
260+00	992.80	982.02	10.78	2.0	514	3.5	2.0	514	3.5
+50	992.65	982.15	10.50	2.0	497	3.4	2.0	497	3.4
261+00	992.50	981.94	10.56	2.0	500	3.5	2.0	500	3.5
+50	992.35	981.50	10.85	1.5	550	3.4	2.0	519	3.5
262+00	992.20	980.78	11.42	1.5	585	3.6	2.5	523	3.9
+50	992.05	980.40	11.65	2.0	569	3.8	2.0	569	3.8
263+00	991.90	980.90	11.00	2.0	528	3.6	2.5	497	3.7
+50	991.75	982.60	9.15	1.0	473	2.7	2.5	380	3.2
264+00	991.60	983.92	7.68	1.0	381	2.2	2.5	350	2.4
+50	991.45	986.20	5.25	1.0	228	1.5	2.0	166	1.8
265+00	991.30	987.68	3.62	1.0	125	1.0	2.0	63	1.3
+20	991.30	988.20	3.10	1.0	92	0.8	1.0	92	0.8
	Average Thickness		9.25	1.54		3.02	1.87		3.13

UNDERGROUND CULVERT STRUCTURES

ELASTIZELL EF Reduces Loading Over an Underground Culvert Structure Unable to Support Additional Loads



ELASTIZELL EF Permits Higher Levee and Embankment Structures Over Poor Soils



Please contact the Elastizell Corporation of America for additional specific design values and a customized specification.

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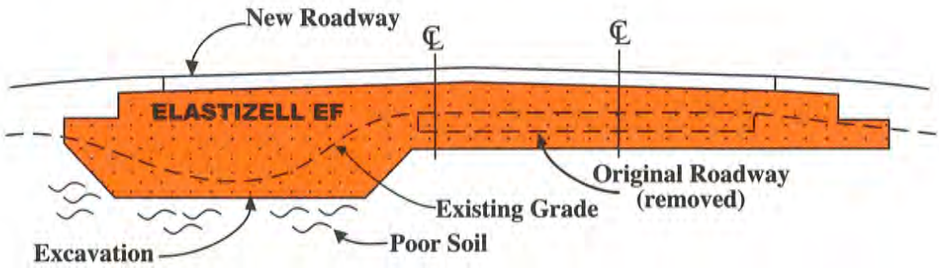
ELASTIZELL EF (Engineered Fill)

[redacted]

RESEARCH REPORT ***Geotechnical Applications***

ROADWAY FILLS

Many two lane roads in the Midwest have raised road beds with sides sloping down to soils that are rich for farming but poor as a future roadway base. When these roads are widened, it is necessary to accommodate these poor soils under the widened road and shoulder. **Elastizell EF** provides an ideal subbase for a widened roadway over these poor soils.



PROBLEM:

Long term settlement of a roadway over poor soil requires regular maintenance. Adding more asphalt to level the roadway is a temporary treatment that causes additional settlement. Just maintenance is not a permanent solution to this site condition.

SOLUTION:

Removing the very thick asphalt roadway section and installing **Elastizell EF** may unload the soil by more than 200 psf. These soils have been surcharged by the original roadway and subsequent corrective layers of asphalt. Removing existing material and replacing it with the much lighter **Elastizell EF** subbase reduces future settlements.

SPECIALTY CONCRETE CONTRACTORS

CELL-CRETE CORPORATION

ENGINEERED FILL

Colton Crossing Colton, CA

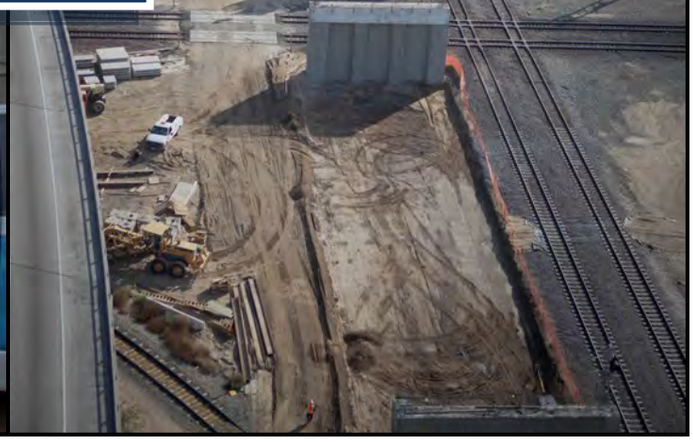
Total Cubic Yards: 220,000

Project Savings: $109 million and 9 months

Project Description: The Colton Crossing is a major crossing of the BNSF and UP rail lines in Southern California. The project involved the construction of a 1.4-mile-long overpass to remove the chokepoint and elevate two UP east-west tracks above the BNSF north-south line.

Why Lightweight Cellular Concrete?: With settlement and movement concerns for standard MSE backfill and the high cost of building cast in place walls or a bridge, Lightweight Cellular Concrete and MSE panels was accepted as the most efficient method to lift the new rail line. The Lightweight Cellular Concrete and MSE panels created a lightweight self supporting mass of cohesive fill behind a MSE Panel facade . The fill has a compressive strength (psi) seven to ten times stronger than typical compacted soil. Additional benefits were realized by limiting the amount of truck traffic to one (1) truck for every 120 cy's of material, the seismic benefits of lightweight fill and overall speed of construction.

…"Estimated to cost $202 million and scheduled to open in 2014, the project wrapped up eight months ahead of schedule and cost $93 million primarily because of innovative construction methods and a competitive marketplace that resulted in lower-than-expected bids", **the owner said in a press release.**

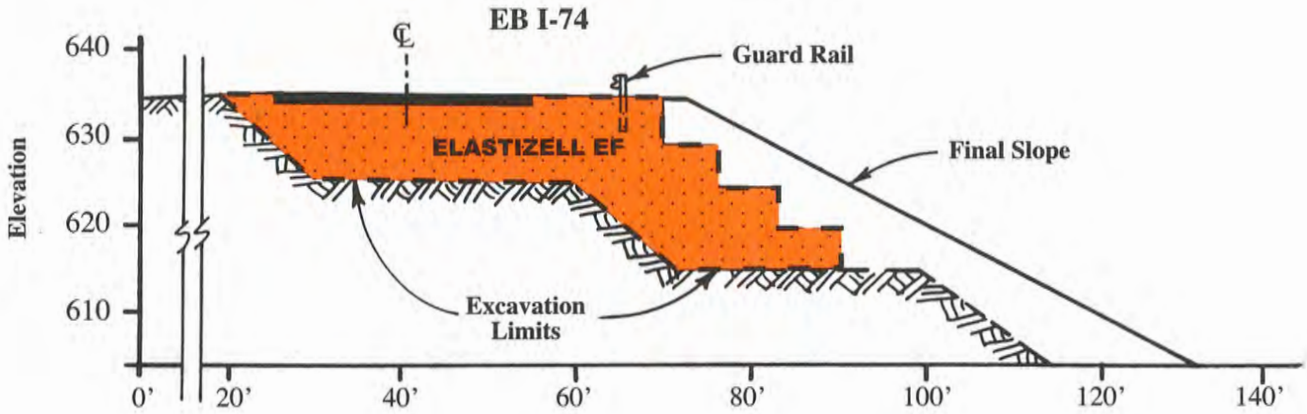


Project:	I-74 west of Cincinnati
Location:	Hamilton County, OH
Completed:	August, 1986

The renovation of I-74, which had substantial side slope movement, utilized a terraced **Elastizell EF** solution to reduce the load on the poor soil. Settlements were so significant that the eastbound portion of the Interstate was closed.

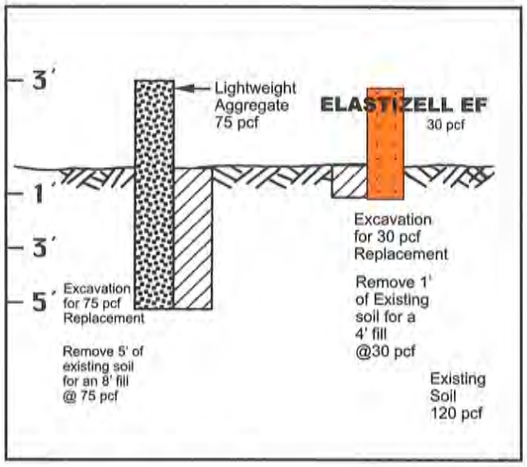
Recent Example: West County Connector, Los Angeles, CA

Maintenance corrections merely added asphalt (weight) to the underlying soil and effectively surcharged it. This continuing maintenance headache was solved with the permanent **Elastizell EF** solution. The lighter **Elastizell EF** significantly reduced the dead load at this site under both the road and the shoulder. The asphalt road and overlays (120 pcf) were replaced with the **Elastizell EF** averaging 30 pcf. Stepped **Elastizell EF** controlled the dead weight, volume and cost of this renovation.



- **Elastizell EF** is a proven and permanent solution that does not endanger the environment.
- **Elastizell EF** is easily excavated for future access to underlying utilities.
- **Elastizell EF** allows for widening of roadways with steep shoulders. It offers long term savings with no maintenance.
- **Elastizell EF** provides a cost effective and time saving solution.

Elastizell EF vs. Lightweight Aggregate



Load Balancing Method

Excavate:
1' roadway @ 120 pcf = 120 pcf

1' existing soil @ 120 pcf = 120 pcf

2' 240 pcf

Replace:
1' roadway @ 120 pcf = 120 pcf

2' Class IV EF @ 36 pcf = 72 pcf

2' Class II EF @ 24 pcf = 48 pcf

5' = 240 pcf

Note: 3' gain in elevation with no gain in dead load

Comparison of Fill Material Densities

Elastizell EF Class I	18-24 pcf
Elastizell EF Class II	24-30 pcf
Elastizell EF Class III	30-36 pcf
Elastizell EF Class IV	36-42 pcf
Water	62.4 pcf
Lightweight Aggregates	60-90 pcf
CLSM Fly Ash Slurries	90-120 pcf
Soils	120 pcf
Controlled Density Fills (CDF)	125 pcf
Aggregates	125 pcf
Lean Concrete	145 pcf

EXAMPLE SOLUTION

IA DOT Project - US 63 over Sugar Creek - Clay Fill Calculation using Load balancing

Volume calculations based on load balancing depth calculations - width of fill assumes full width under EF.

Station	Estimated Bottom of Excavation (m)	Estimated Top of Clay Fill (m)	Depth of Clay Fill (m)	Overall width of Clay Fill (m)	Width at top of Clay Fill (m)	Cross Sectional Area (m2)
177+20	209	214.33	5.33	110	110	586.3
177+40	209	211.67	2.67	118	118	315.06
177+60	207	209	2	124	124	248
177+70	206	209	3	126	126	378
177+82	206	208.33	2.33	130	130	302.9
178+25	206	208.33	2.33	130	130	302.9
BRIDGE						
178+80	210	217	7	90	90	630
179+00	214	222.5	8.5	109	109	926.5
179+20	217	221	4	92	92	368

Station From	Station To:	Cross Section Area 1 (m2)	Cross Section Area 2 (m2)	Distance between Stations (m)	Est. Volume of fill (m3)	
177+20	177+40	586.3	315.06	20	9013.6	
177+40	177+60	315.06	248	20	5630.6	42,154 m3 this side
177+60	177+70	248	378	10	3130	
177+70	177+82	378	302.9	12	4085.4	
177+82	178+25	302.9	302.9	67	20294.3	
BRIDGE						
178+80	179+00	630	926.5	20	15565	28,510 m3 this side
179+00	179+20	926.5	368	20	12945	
				Total Estimated Volume:	**70,664**	**cubic meters**
					92,425	**cubic yards**

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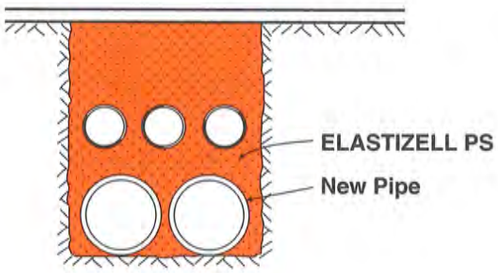
ELASTIZELL PS
(Pipeline Solutions)

RESEARCH REPORT

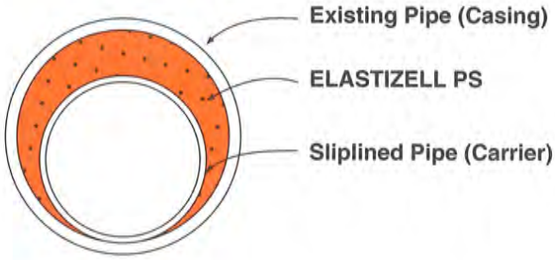
Cost Efficient Pipeline Applications

TRENCHED



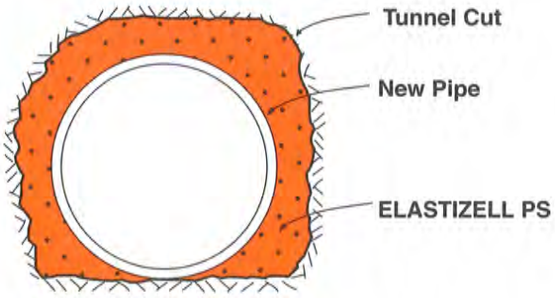
Increases life performance and stability. Easily excavated. Reduces settlement.

SLIPLINED



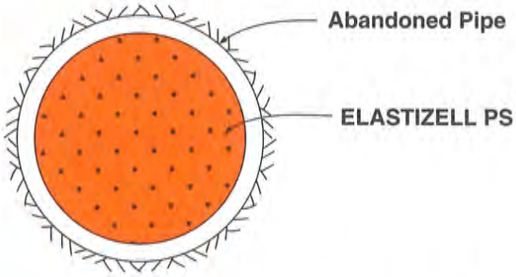
Completely fills annular space stabilizing the carrier pipe. Low grouting pressures and low buoyant forces.

TUNNELLED



Reduces lateral pressure and completely fills void. Fast installation. Flowable.

ABANDONED



Eliminates surface trenching disruption. Reduces dead load and settlement.

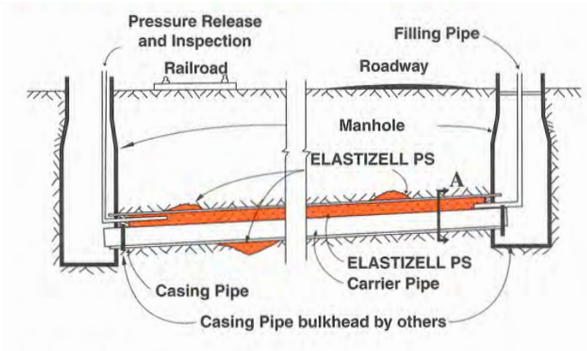
Elastizell Corporation of America

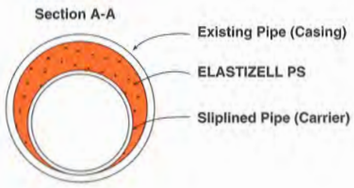
SLIPLINED - CASING & CARRIER

Elastizell PS is an ideal material for grouting the annular space in sliplined or casing & carrier sewer pipeline applications because of its stability, low density, and flowability.

- The stability of Elastizell PS assures a consistent material meeting the design criteria.
- Low density Elastizell PS permits the installation in one lift. This reduces the chances of floating the carrier pipe. Precautions preventing carrier pipe buoyancy should be considered. See procedures below.
- The flowability of Elastizell PS permits pumping at low pressures, reducing the risk of damage to the carrier pipe which may occur with heavier and less flowable grouts.

ELASTIZELL PS - SLIPLINED PIPE





Procedure:

1. The casing pipe is bulkheaded at both ends by others. The carrier pipe is filled with potable water or from the sewer flow, or it may be blocked or anchored in the casing pipe to prevent flotation.
2. Typically, fill and relief lines are installed at the bulkheads by others.
3. Elastizell PS is pumped into the annular space at low pressure completely filling voids.

Problems with Other Grout Materials:

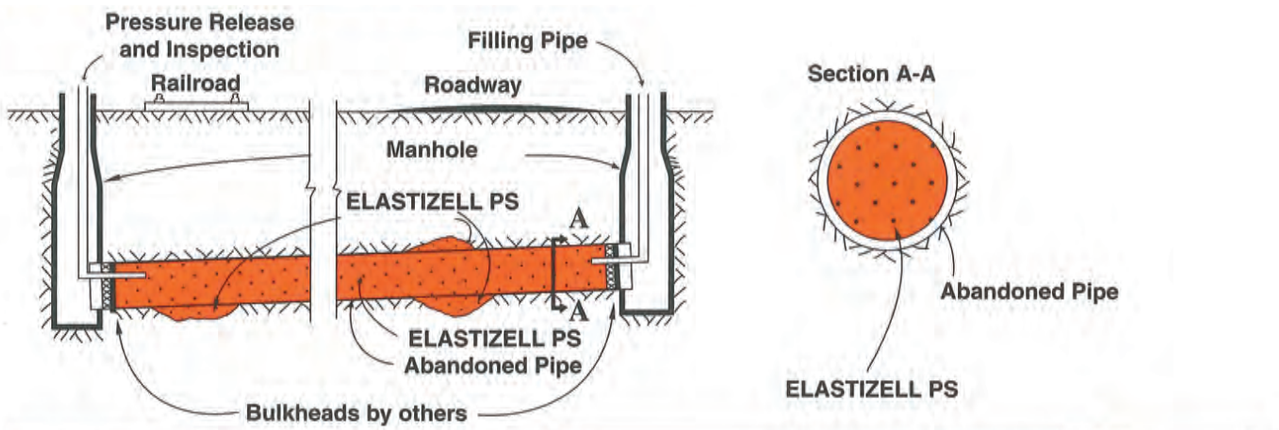
- Flotation of the Carrier Pipe with higher grout densities.
- Incomplete filling or plugging of the annular space due to lack of flowability.
- Carrier pipe collapse due to high pumping pressures and the hydrostatic pressure differential of a heavier grout.

ABANDONED

It is often more economical to fill an abandoned pipeline with Elastizell PS than to excavate and remove it.

- Elastizell PS fills erosion voids at pipe joints or at broken sections.
- Without workers in the excavation, it is a safe void filling method. Compaction is not required.
- The speed of installation provides an economical method for filling voids.
- Flowability of over 1200 feet is possible, depending on density and mix design.

ELASTIZELL PS - ABANDONED PIPE



Quality formwork is recommended.

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COMMON QUESTIONS ABOUT PIPELINE APPLICATIONS

Q: ***What density is recommended for pipeline fills?***

A: **Although Elastizell PS 120 is preferred for most standard pipeline fills, specific densities and strengths may be customized for a particular application.**

Q: ***Is the low density of Elastizell PS significant?***

A: **Elastizell PS at one-fourth the weight of lean fill has acceptable load bearing qualities. Mix designs may be customized for special strength requirements. The listed strengths are acceptable for most applications.**

Q: ***How far will Elastizell PS flow before another inlet is needed?***

A: **Pumped Elastizell PS has flowed up to 1200 feet between manholes, depending on mix design and annular space conditions. Actual conditions and requirements must be evaluated for specific mix designs.**

Q: ***How effective is Elastizell PS at filling voids in and around pipelines?***

A: **Elastizell PS is highly flowable, and fills cracks and voids around the casing pipe.**

Q: ***What if there is standing water in the void?***

A: **Elastizell PS 120 and heavier will displace small amounts of standing water. This is mainly due to the cohesive nature of this material, which displaces the water.**

Q: ***Will the carrier pipe float in the annular pace of a slipline application?***

A: **If floating is a concern, the carrier pipe can be filled with water, blocked, or anchored to prevent floating. Existing flow is diverted to carrier pipe to fill the pipe. Simple buoyancy calculations determine the % of the carrier pipe that must be filled to prevent flotation for a specific density of Elastizell PS.**

Q: ***Are hydration temperatures a problem?***

A: **Pipe manufacturers indicate that PVC pipe is formed at 400°F with reheating to 300°F for forming the bell. A PVC carrier pipe should contain circulating water up to 72 hours after casting. This may vary due to specific job conditions. Elastizell PS hydration temperatures may reach 130°F to 180°F for a period of a few hours about 24 hours after the material is placed.**

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ELASTIZELL EF (Engineered Fill)

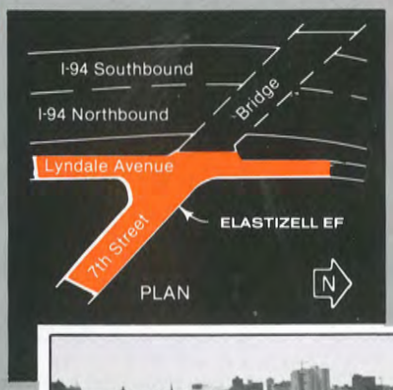
BRIDGE APPROACH APPLICATIONS

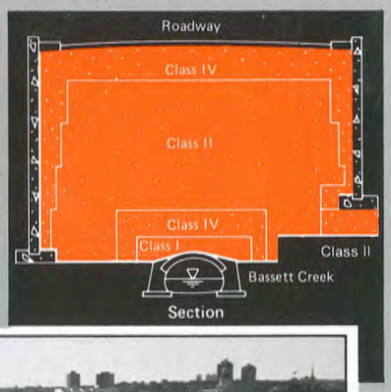
40,000 Cubic Yards of ELASTIZELL EF Saves $1½ Million at I-94 Bridge Approach

PROBLEM: A deep mucky soil condition cannot support a normal weight fill needed to ramp roadways to the elevation of a new bridge deck over I-94 west of downtown Minneapolis.

ADVANTAGES

- Much lower first cost than other solutions.
- Saves subsequent costly maintenance of a structure bridging this area.
- Three densities of **ELASTIZELL EF** satisfied three specific requirements.





Minnesota Department of Transportation. Applicator: Place-Crete, Inc., Dayton, Ohio

ADVANTAGES

- Fast installation moves the entire project ahead of scheduled completion.
- Does not disrupt the uncertain subsoil condition so there are no time delaying surprises.
- **ELASTIZELL EF** exerts minimal horizontal pressure on the retaining walls and bridge abutment.

7th Street & Lyndale Avenue Bridge Approach at I-94. Minneapolis, Minnesota

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SOLUTION

Four solutions to this problem were considered by the Minnesota Department of Transportation (MnDOT). These solutions were complicated by both the poor soil conditions and the proximity of existing buildings (businesses) adjacent to the site. These solutions included:

- Pay to have the equipment in the adjacent building moved and buy this building so that additional site space could be obtained. This was impractical from a cost standpoint.

- Drive sheet piling near this building to depths of more than 80 feet so that much of the mucky soil could be excavated. This was a high risk and costly solution.

- Span the entire area of mucky soil with a structure that would carry both 7th Street (bridge approach) and Lyndale Avenue (frontage road). This was a reasonable solution, but was about 1½ million dollars more expensive than the **ELASTIZELL EF** solution.

- Utilize **ELASTIZELL EF** to raise the streets to the bridge elevation and not overload the mucky soil present at this site. This solution was ultimately selected.

Recent Example:
Bay Bridge,
Oakland to San Francisco

Recent Example:
Bimbo Bakery,
Portland, OR

DISCUSSION

The MnDOT was innovative in utilizing the unique characteristics of **ELASTIZELL EF** in their design and specifications. They called for three different classes of **ELASTIZELL EF** to solve three specific problems present at this site.

1. A Class I **ELASTIZELL EF** with a density of about 18 pcf is utilized over an old underground culvert structure which cuts through the fill area. This material is designed to crush and not damage the culvert if any settlement occurs.

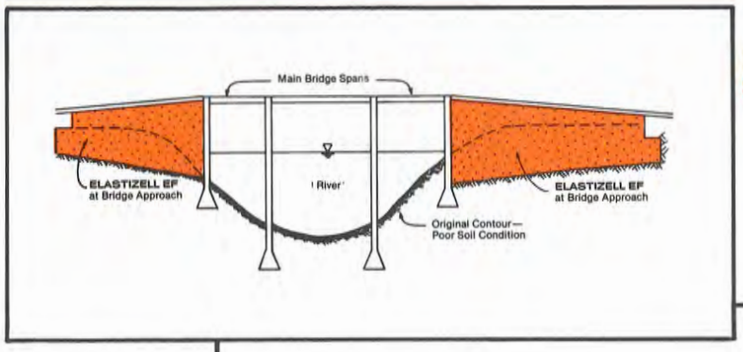
2. Class II **ELASTIZELL EF** with a density of 25 pcf is used for the bulk of the fill. It is designed so that it won't overload the mucky soil at this site. The compressive strength requirement for this material is 50 psi (7200 psf).

3. The Class IV **ELASTIZELL EF** with a density of 32 pcf envelopes the fill at the retaining walls on the side and over the top surface of the fill under the asphalt roadway and base. This density was selected for its excellent freeze/thaw characteristics.

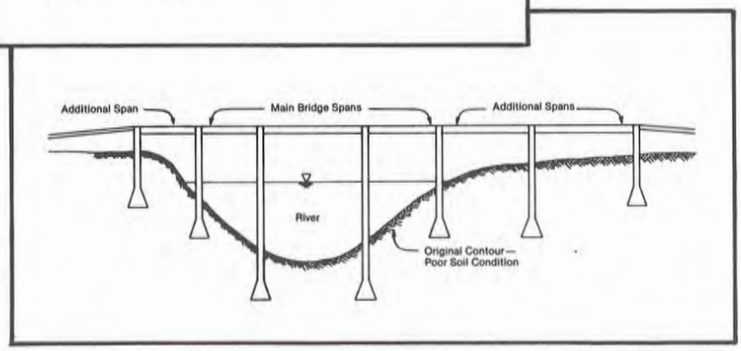
ELASTIZELL EF is often a Cost-Efficient Solution in Other Bridge Approach Applications.

One application is a bridge crossing where poor soils exist at the river's edge, next to and below the bridge abutment. If these soils are too deep for complete excavation, partial excavation and replacement with **ELASTIZELL EF** will permit the roadway to be raised to the bridge deck elevation without overloading the poor soil underneath. This is a load balancing technique.

The alternate bridging solution requires the costly construction of additional bridge spans and deep support piling—i.e., a "land bridge." The other advantage of an **ELASTIZELL EF** bridge approach in lieu of the "land bridge" is that the "land bridge" will have increasing maintenance costs over its lifetime while the **ELASTIZELL EF** has none.

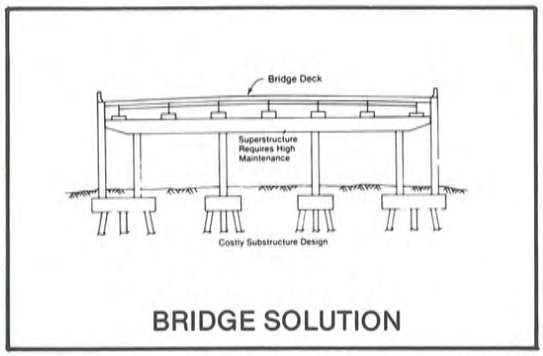


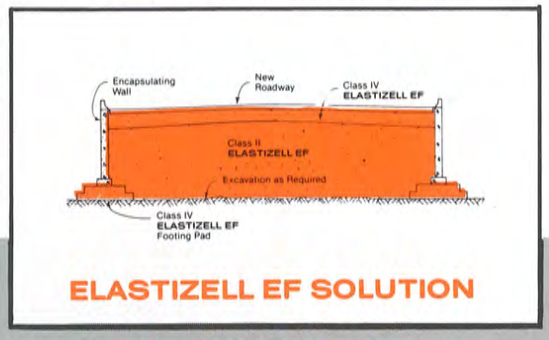
IDEAL SOLUTION



COSTLY ALTERNATIVE

Heavy equipment operates directly on 25 pcf ELASTIZELL EF.



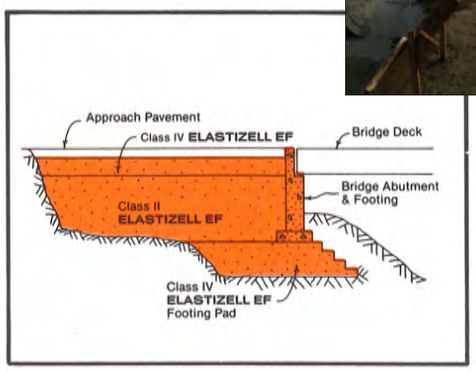


Another application occurs at locations where it is necessary to have a high embankment for a bridge approach, but the area is underlain with very poor soils often too deep to either excavate or economically justify pile supports. If a 20 to 30 foot soil embankment or surcharge was built, it would overload the underlying soil and cause large settlements which may never reach equilibrium.

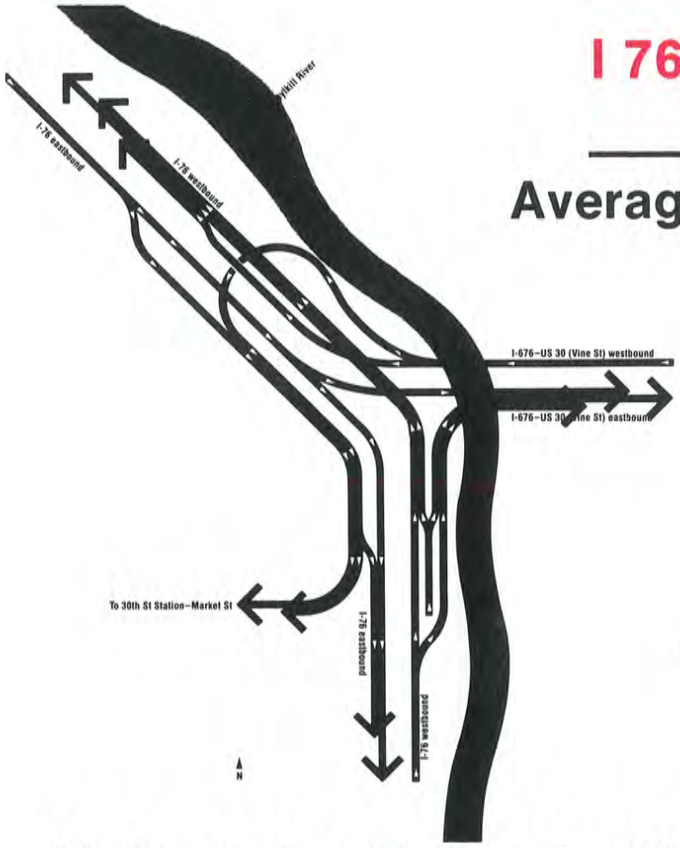
Furthermore, in urban areas, surcharging requires space and time, both vital considerations which may dictate the need for an innovative **ELASTIZELL EF** solution. In this case, the bridge abutment and wingwall footings were supported on a specially designed footing pad of **ELASTIZELL EF** to distribute the bearing loads of the structure.

Item	ELASTIZELL EF	Bridge
PILING	*no*	*yes*
EXCAVATION	*minimal*	*yes*
INSTALLATION	*faster*	*slower*
FIRST COST	*lower*	*higher*
MAINTENANCE	*none*	*yes*

I-405 Project
Los Angeles, California
for CALTRANS



Specially designed ELASTIZELL EF footing pad (six feet thick) for bridge abutment and wing wall. ELASTIZELL EF was also placed about 14 feet thick behind the abutment and wing walls.



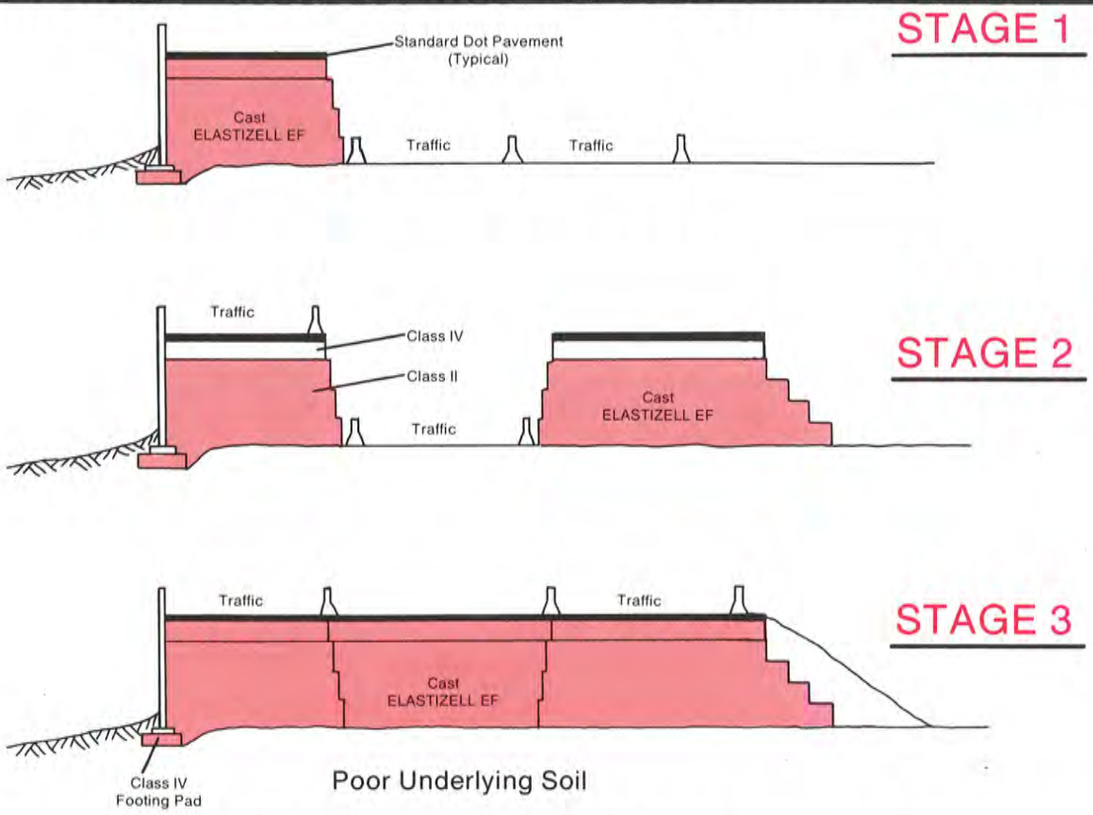
I 76 Schuylkill Expressway Reconstruction

Average Daily Vehicles @ 144,000

ELASTIZELL EF IS THE SOLUTION!

- **Traffic Maintained Throughout 5 Stages & Switchovers During Construction Period**
- **Adaptability of ELASTIZELL EF High Performance Solution Results In On Time Completion**

Maintaining Urban Traffic Throughout Construction



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ELASTIZELL EF (Engineered Fill)

RESEARCH REPORT

Bridge & Culvert Construction & Rehabilitation

Traffic maintained, by-pass not required

Extending bridge width

- **Eliminates Compaction**
- **Resists Washouts from Floods or High Water**
- **Provides a Load Reducing Fill Over Pool Soils**
- **Preserves the Existing Infrastructure**
- **Maintains Traffic and Widens Narrow Crossings**
- **Permanent Solution – Low Cost**

BRIDGE REHABILITATION

PROBLEM:

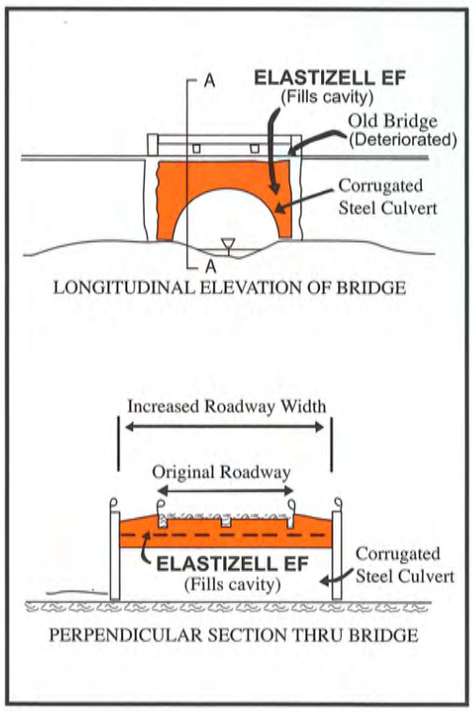
A bridge over a small creek on a federal highway has deteriorated and must be replaced.

SOLUTION:

1. A corrugated steel culvert is placed within the bridge opening.

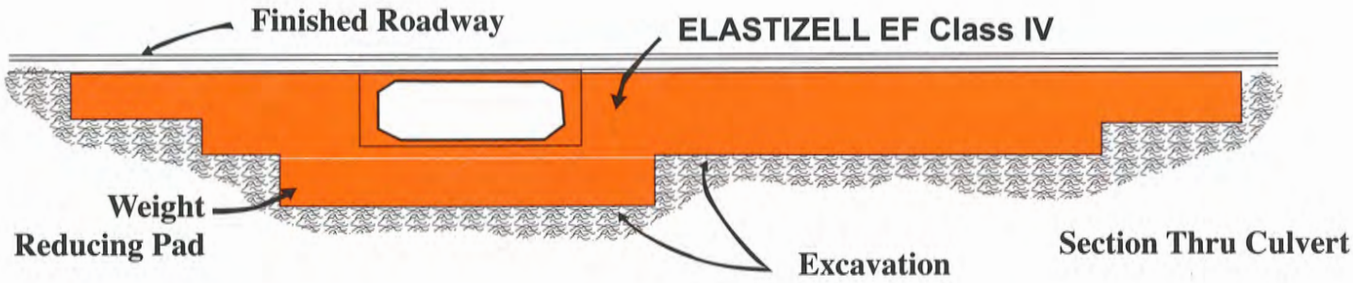
2. Culvert end walls are constructed to permit widening of the bridge and roadway.

3. The entire void is filled with **Elastizell EF** which fully supports the original bridge.



Totem Lake, WA
Unacceptable loads on structure

- **Elastizell EF Distributes Loads Over Poor Soil**
- **Fast Installation**
- **Permanent Solution Which Resists Washouts**
- **No Compaction Required**
- **Reduce Loads Around the Culvert**



PROCEDURE:

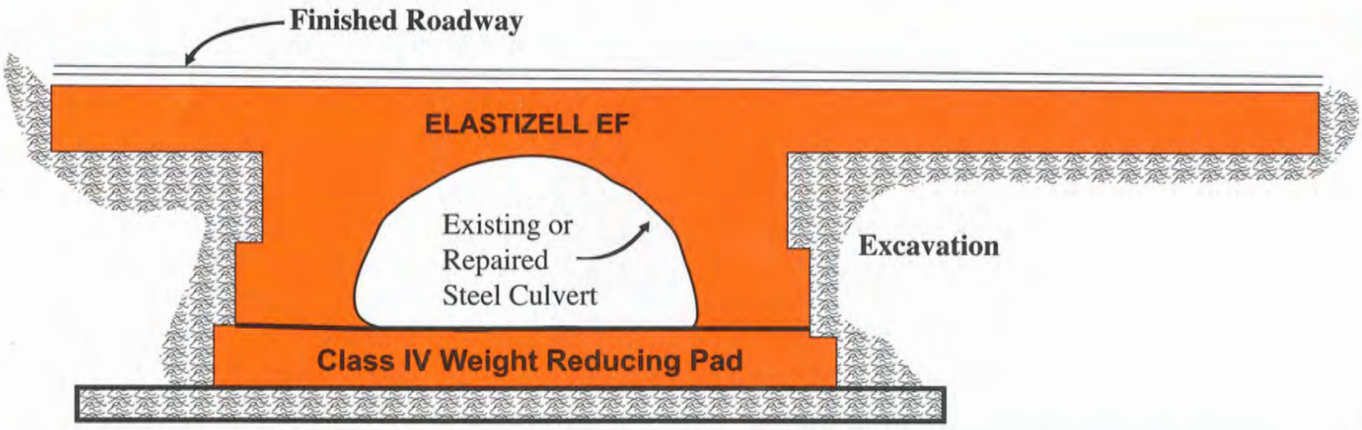
1. Divert the stream, excavate, and place the **Elastizell EF** base for the box culvert. The base thickness depends on the existing soil conditions.

2. Install the box culvert on the pad and place **Elastizell EF** as the approach roadway base.

3. Place a flexible or rigid pavement over the **Elastizell EF** approach and the box culvert.

STEEL ARCH CULVERTS

- **Rehabilitate Overloaded and Damaged Culverts**
- **Reduce Maintenance Costs**
- **Fast Installation Reduces Traffic Delays**
- **No Compaction Required**
- **Permanent & Lightweight Solution Reduces Settlements**



ELASTIZELL EF CLASS	MAXIMUM CAST DENSITY pcf	MINIMUM COMPRESSIVE STRENGTH psi	ULTIMATE BEARING CAPACITY Tons/sf
I	24	10	0.7
II	30	40	2.9
III	36	80	5.8
IV	42	120	8.6
V	50	160	11.5
VI	80	300	21.6

Please contact the Elastizell Corporation of America for additional specific design values and more detailed specifications.

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ELASTIZELL EF (Engineered Fill)

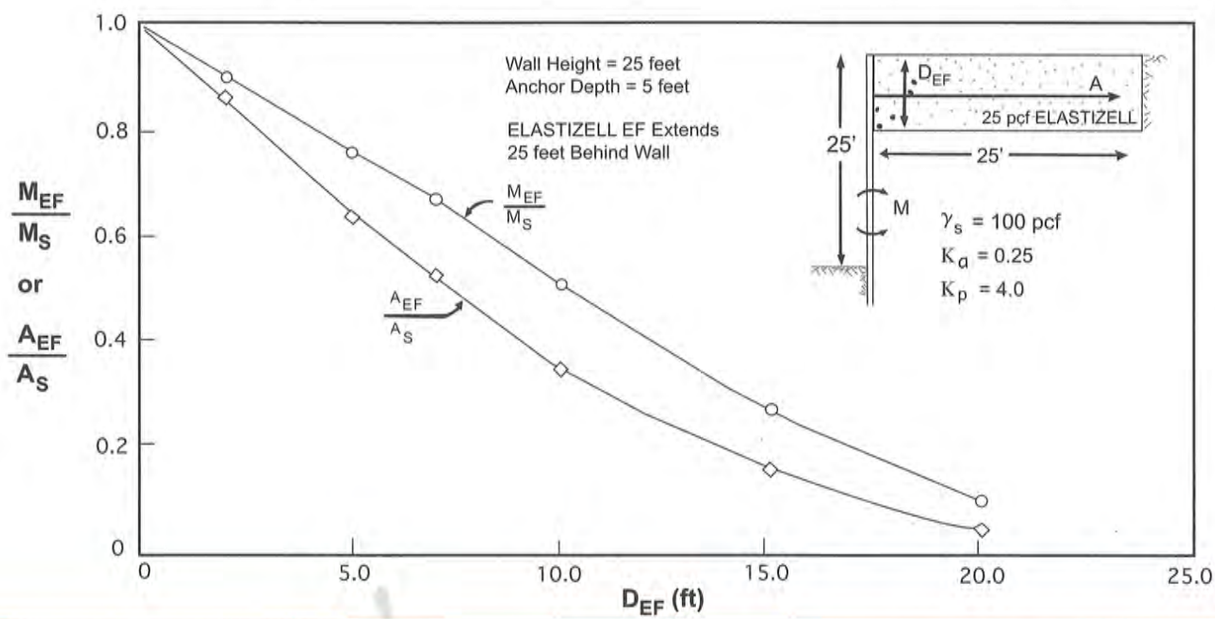
RESEARCH REPORT

The Computed Effect of Various Design Parameters

- **Overturning Moment**
- **Bending Moment**
- **Sliding Force**
- **Anchor Pull**

from Elastizell EF as a Soil/Backfill Replacement with Different Configurations Behind Retaining Walls.

Computed Reduction in Wall Bending Moment and Anchor Pull from Replacement of Backfill with **Elastizell EF**



Elastizell Corporation of America

ASSUMPTIONS

1. All of these analyses utilized the theory for active earth pressures (Coulomb's Earth Pressure Theory) as outlined in Lambe & Whitman, *Soil Mechanics*, John Wiley & Sons. From the theory, a coefficient of active earth pressure, K_a, is computed. This coefficient relates the horizontal forces generated by the soil to the depth and unit weight of the soil: $K_a = f(\delta, \varphi)$

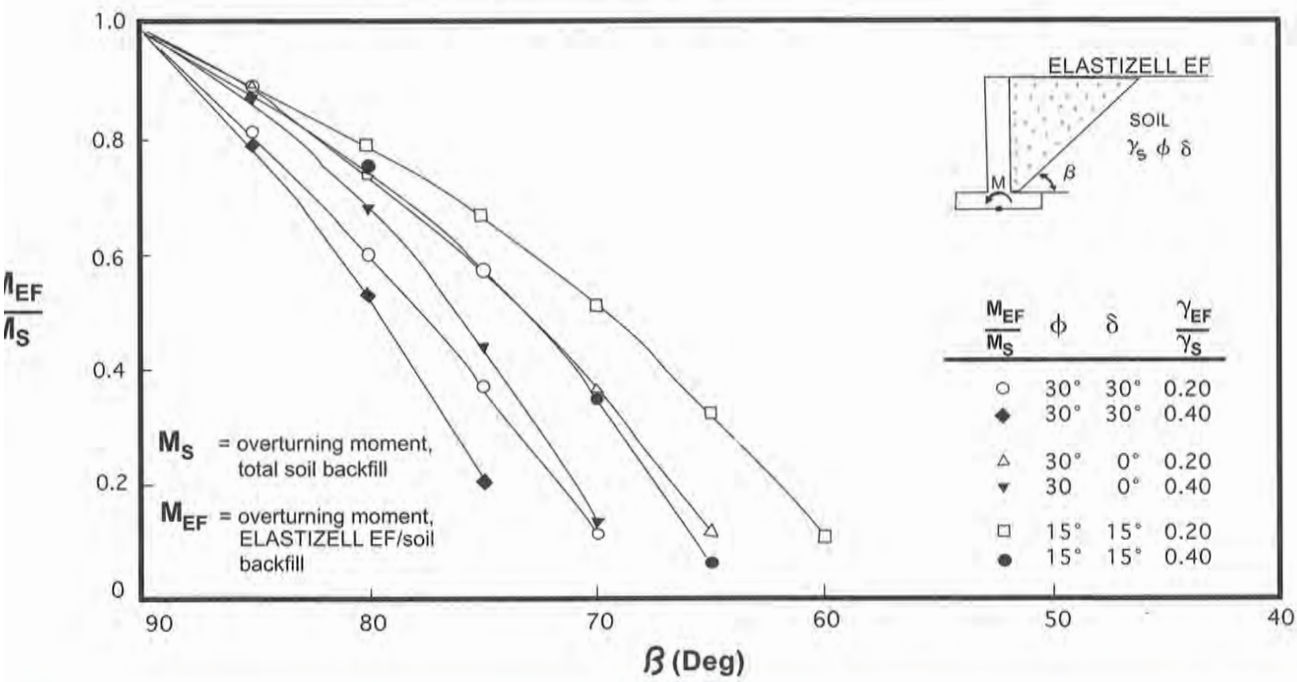
2. All analyses assumed that the active earth condition has developed, i.e., the wall is permitted to move slightly.

3. All analyses assumed a cohesionless backfill. If the backfill is cohesive, adjustments to the active earth pressures can be made based on past experience with the particular soil in a specific location. For some of the analyses, the results are independent of the actual value of active earth pressure since dimensionless ratios are used.

4. Another assumption is that the **Elastizell EF** contributes pressure on the wall through the soil below. In the partial wedge studies, the **Elastizell EF** is assumed to transfer earth pressure from the soil behind it onto the wall.

5. The partial wedge studies assume the **Elastizell EF** reduces wall forces by two mechanisms:
   a) Since it replaces soil that is heavier, it reduces load.
   b) Its own weight resists overturning forces from the soil since it acts as a solid mass. The straight backfill case also resists sliding at its base.

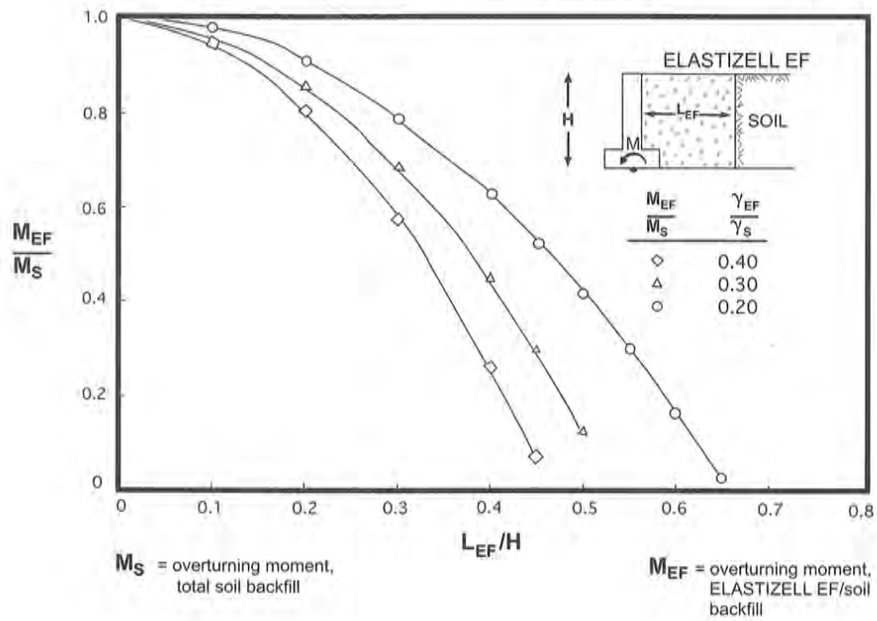
Computed Reduction in Overturning Moment at the Base of a Retaining Wall from Replacement of Backfill with **Elastizell EF** in a Wedge Configuration

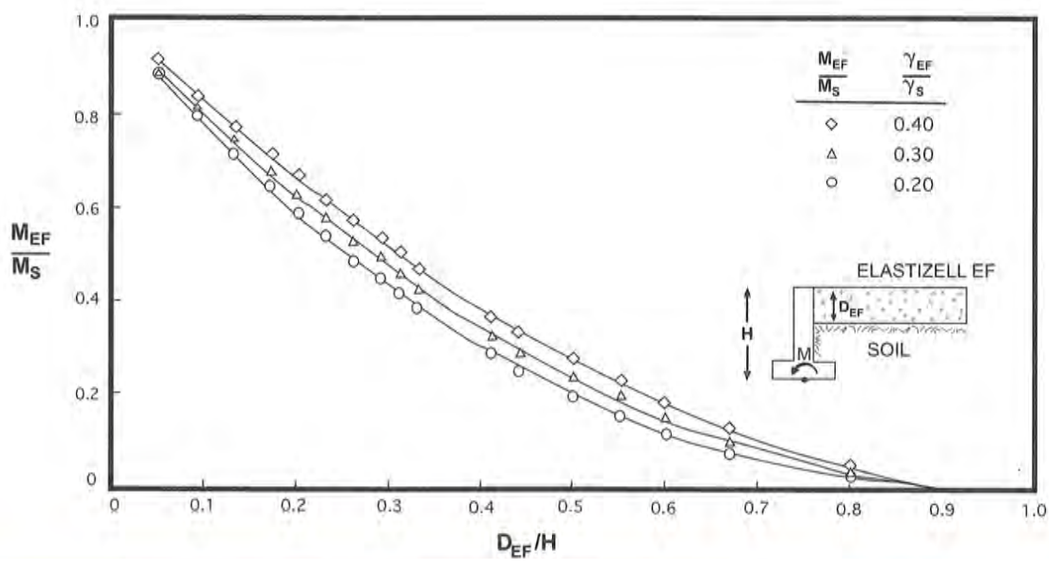


REMARKS

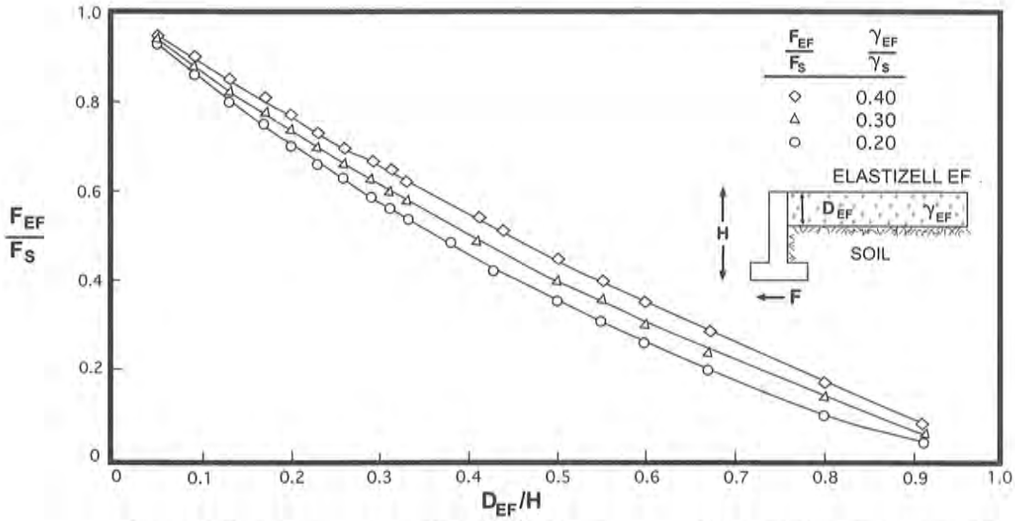
Many retaining walls fail due to poor drainage of their backfills. Typically, the walls can retain the loads that they are designed for, but water forces can double the design loads and cause failure of the retaining wall. However, these water forces will not build up if adequate drainage is provided. The combination of **Elastizell EF** as a total or partial replacement of standard, heavy backfill materials and the proper drainage system offer the designer the alternate of lighter retaining walls and footings with a backfill material – **Elastizell EF** – which will not capture water and build up these increased forces.

Computed Reduction in Overturning Moment at the Base of a Retaining Wall from Replacement of Backfill with **Elastizell EF** in the Block





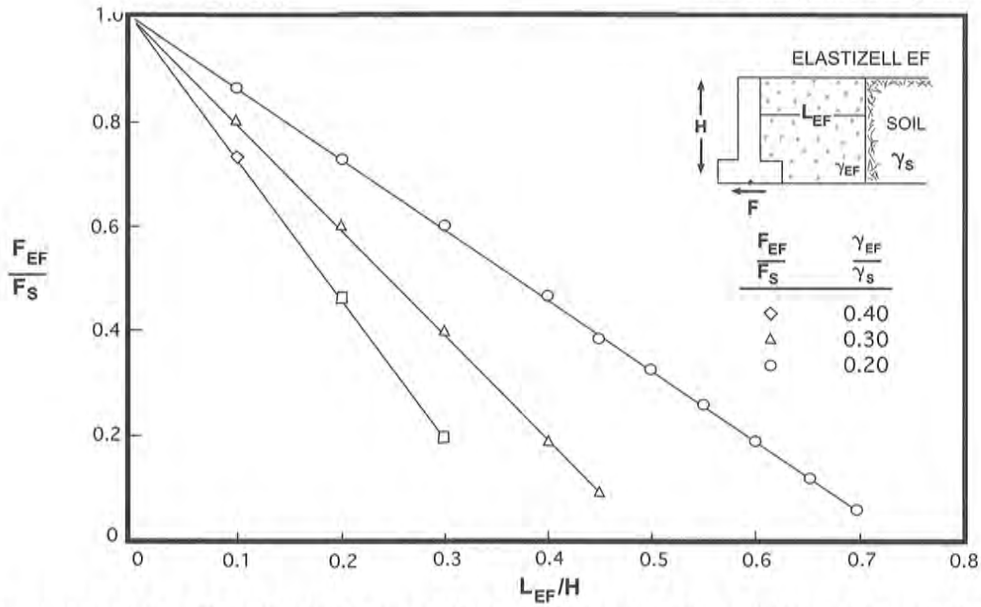
Computed Reduction in Sliding Forces at the Base of a Retaining Wall from Replacement of Backfill with **Elastizell EF**



F_{EF} = sliding force, **Elastizell EF**/soil backfill

F_S = sliding force, total soil backfill

Note: Sliding resistance may be substantially increased by keying the footing into the ground.



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ENGINEERED FILL

West County Connector
Long Beach, CA
Cubic Yards: 75,000

With over 900,000 daily trips, the congested 6-mile West County Connector project is a partnership between OCTA and Caltrans linking high occupancy vehicle (HOV) lanes/carpool lanes on I-405 with those on SR-22 and I-605 to create a seamless carpool connection amongst the three freeways.

The project had 8 proposed MSE walls with Cellular Concrete, design heights ranging from 6 feet to a maximum of 33 feet. Total length of these proposed walls is 3,982 linear feet. Due to the presence of a firm to stiff clay layer present between typical elevations of El. +15 to +22 feet (top of layer) to El. +3 to +8 feet (bottom of layer), the wall foundation soils generally have low bearing capacity and potentially large settlements under wall loading.

With Cellular Concrete's lower cost compared to traditional ground improvement alternatives, the West County Connector benefitted from significant savings in time, less uncertainty of the total settlements and rates of settlements, and ease of construction.

Additionally, in the confined high traffic area where these HOV connectors were located, eliminating truck traffic from traditional backfill material was a big win for OCTA. Each truck of cement provided up to 120 cubic yard of Cellular Concrete compared to 10+ trucks of traditional backfill to equal the same volume.

SPECIALTY CONCRETE CONTRACTORS

CELL-CRETE CORPORATION

ENGINEERED FILL

Doyle Drive

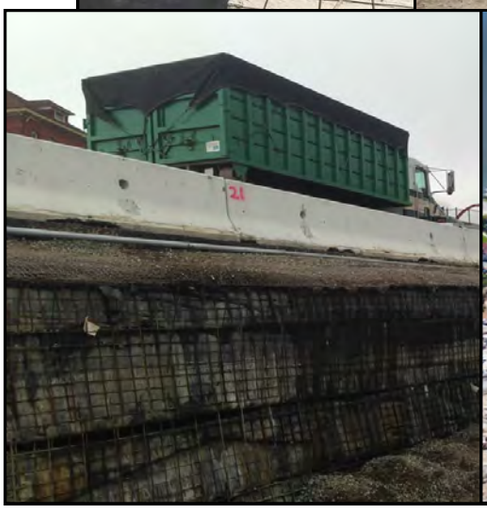
San Francisco, CA

Cubic Yards: 13,000 behind a Welded Wire Retaining Wall

Project Savings: $2 million

Project Description: The Doyle Drive project is the reconstruction of the Northbound access to the Golden Gate Bridge. The project involves 5 major contracts including new bridges and tunnels.

Why Lightweight Cellular Concrete?: A new detour is included in the project that was constructed over soft soils. It was originally designed as Geofoam behind a 14' high cast-in-place wall. The contractor chose to value engineer using the Caltrans CRIP program. They proposed Lightweight Cellular Concrete and a welded wire wall. Lightweight Cellular Concrete behind Welded Wire Retaining Walls was a tremendous cost savings option reducing the construction schedule and big savings on the cost of materials and labor. Even higher savings than a typical switch since a permanent face was never installed! Additional benefit of 70% less material to haul away when the detour is removed. Lightweight Cellular Concrete and welded wire retaining walls have become an inexpensive way to build a wall of any height. Simply put on precast wall panels, shotcrete, or stucco for a tough finish.

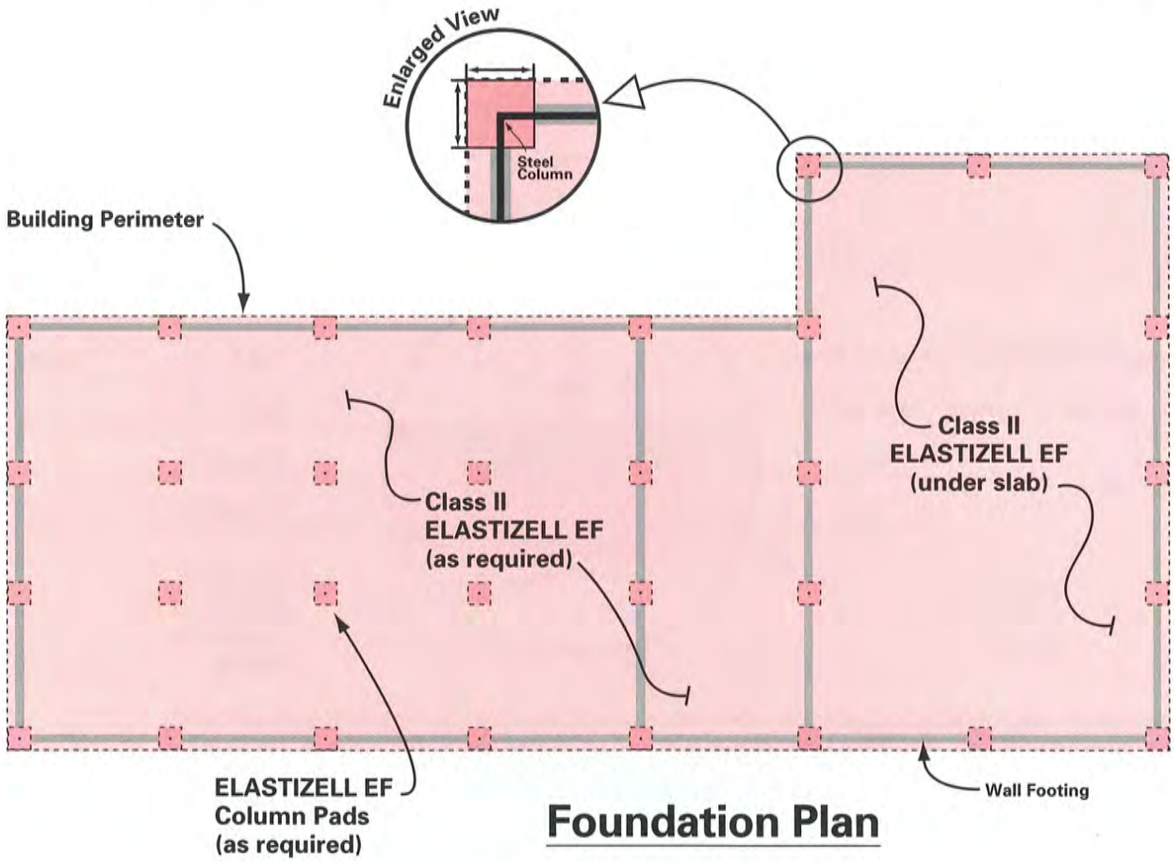


Geotechnical – Innovative Solution

ELASTIZELL EF (Engineered Fill) Building Slab Support Over Poor Soil and Marginal Building Sites

– ELIMINATE PILING –

Combine with Column Footing Pads for Floor Slab Support



Foundation Plan

ELASTIZELL EF is an excellent solution for marginal building sites having poor soil conditions. ELASTIZELL EF reduces the dead load as compared to standard fill or a piling solution. Furthermore, ELASTIZELL EF does not require compacting since it is a cementitious material. It is easily placed in difficult to reach areas (via pumping) and areas where it would be difficult to compact granular fills. It is job site produced in high volumes by specialized equipment producing a cost competitive foundation solution.

ELASTIZELL CORPORATION OF AMERICA

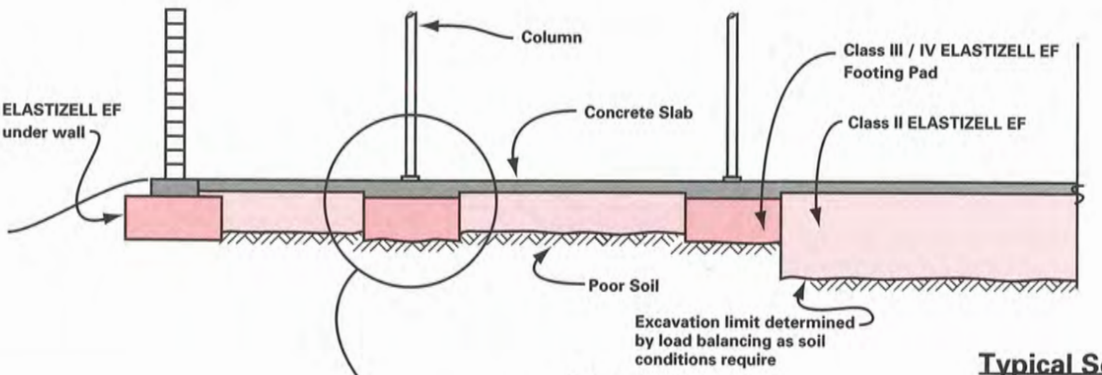
P.O. Box 1462 • Ann Arbor, MI 48106 • tel: 734.761.6900 • fax: 734.761.8016

www.Elastizell.com

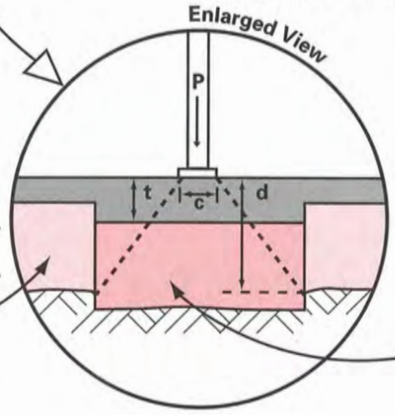
Support Slabs & Columns
Easy Tie Beam Installation
Lighten Load Over Poor Soil
Faster Installation—No Compaction Required
Economical Solution to a Site Problem

Table of Load Balancing Values (Fill Material Densities)

ELASTIZELL EF	
Class I	24 pcf
Class II	30 pcf
Class III	36 pcf
Class IV	42 pcf
Water	62.4 pcf
Soils	120 pcf
Aggregates	125 pcf
Lean Concrete (CLSM)	145 pcf



Typical Section
(not to scale)



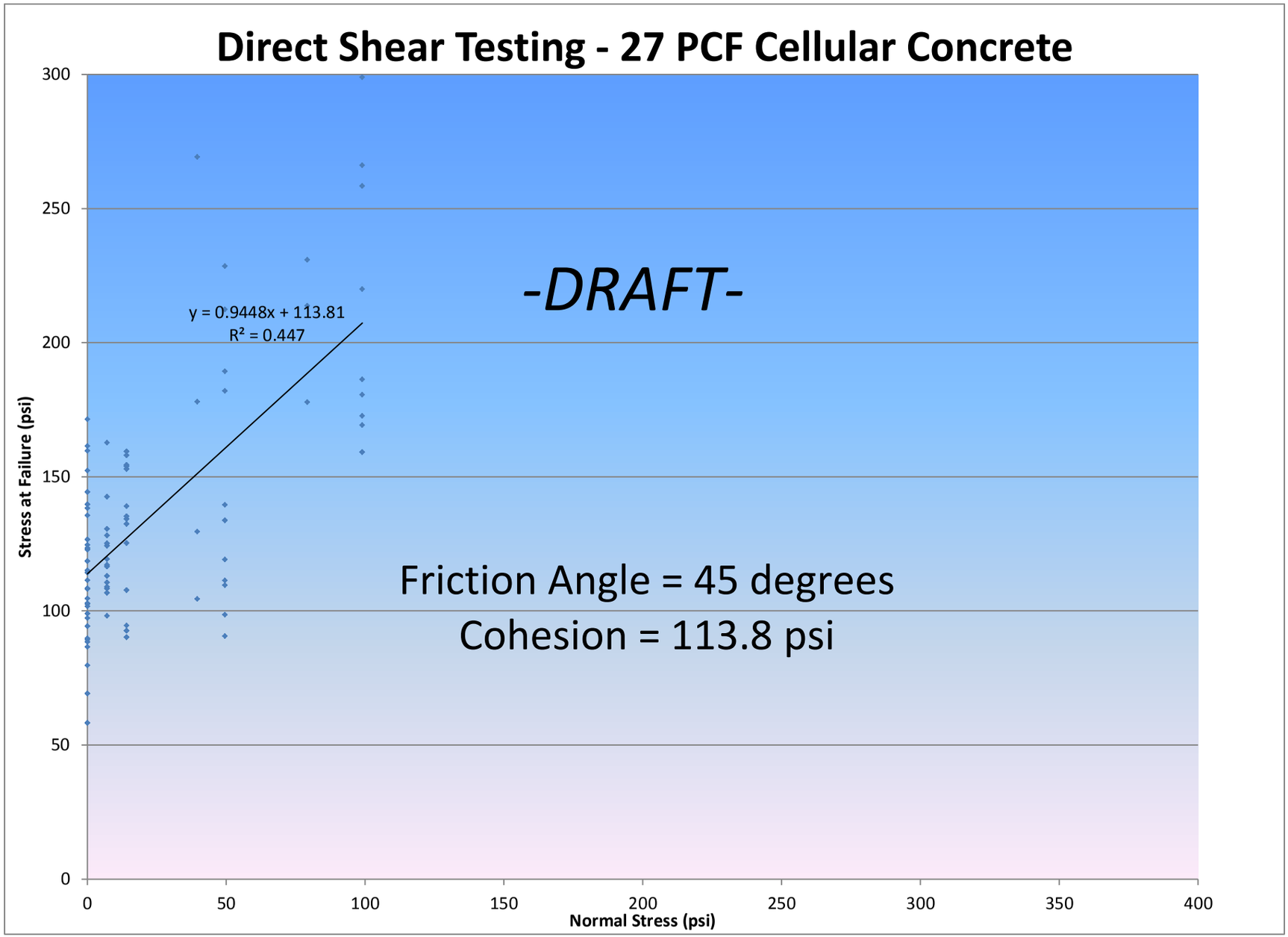
Example Calculation:

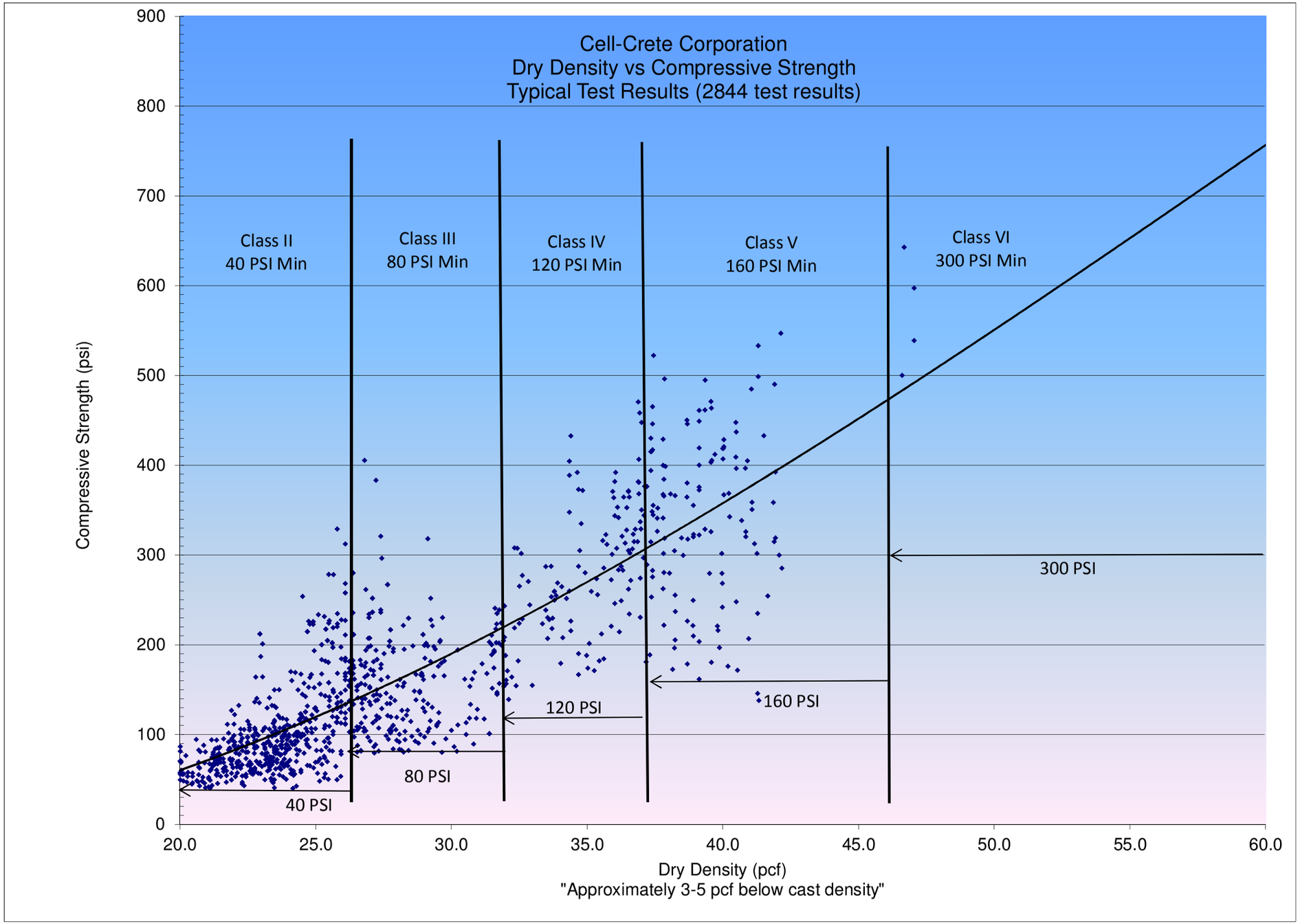
If: P = 20,000#
c = 6"
t = 8"
d = 24"

	Bearing Stress	Load	Bearing Stress
THEN:	555 psi	P/c^2	
	42 psi	$P/(c+2t)^2$	
	7 psi	$P/(c+2d)^2$	

Class II ELASTIZELL EF (25 pcf)

Class III/IV ELASTIZELL EF Footing Pad (36 pcf)


Direct Shear Testing - 27 PCF Cellular Concrete
-DRAFT-
y = 0.9448x + 113.81
R² = 0.447
Friction Angle = 45 degrees
Cohesion = 113.8 psi
Stress at Failure (psi)
Normal Stress (psi)
0
50
100
150
200
250
300
350
400


Cell-Crete Corporation
Dry Density vs Compressive Strength
Typical Test Results (2844 test results)
Class II
40 PSI Min
Class III
80 PSI Min
Class IV
120 PSI Min
Class V
160 PSI Min
Class VI
300 PSI Min
40 PSI
80 PSI
120 PSI
160 PSI
300 PSI
Compressive Strength (psi)
0
100
200
300
400
500
600
700
800
900
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
Dry Density (pcf)
"Approximately 3-5 pcf below cast density"

Short Form SPECIFICATIONS

1. SCOPE OF WORK:

The certified **ELASTIZELL EF** applicator shall furnish labor, materials, equipment, and supervision for the installation of the **ELASTIZELL EF** in accordance with the Drawings and Specifications.

SECTION 02223: ENGINEERED FILLS

Comparison of Maximum Fill Material Densities

ELASTIZELL EF	
Class I	24 pcf
Class II	30 pcf
Class III	36 pcf
Class IV	42 pcf
Water	62.4 pcf
Lightweight Aggregates	60-90 pcf
Soils	120 pcf
Aggregates	125 pcf
Lean Concrete	145 pcf

2. MATERIALS:

.1 **ELASTIZELL EF shall be supplied by the Elastizell Corporation of America and installed by a certified ELASTIZELL EF applicator.** ELASTIZELL concentrate may be tested as described in ASTM C796.

.2 PORTLAND CEMENT shall comply with ASTM C150, Type I, II, III or Block Cement. Pozzolins and other cementitious materials may be used when specifically approved by the Elastizell Corporation.

.3 MIXING WATER shall be potable and free of deleterious amounts of acids, alkali, salts, oils, and organic materials which would adversely affect the setting or strength of the concrete.

.4 ADMIXTURES for water reducing, accelerating, etc. may be used with **ELASTIZELL EF** in accordance with the manufacturer's recommendations as applicable for unusual job conditions.

3. MIX DESIGN:

Mix design shall be in accordance with the Elastizell Corporation's recommendations for a cast density (at point of placement) of_____pcf ±_____pcf with a compressive strength of_____psi at 28 days.

4. MIXING AND PLACING:

ELASTIZELL EF shall be job site batched, mixed, and placed **with specialized equipment certified by the Elastizell Corporation.** Slurry coats, two-density casting and multi-layer casting are acceptable methods of installation.

5. TESTING:

Four (4) test specimens shall be taken at point of placement. Class IV, V, and VI specimens shall be tested in accordance with ASTM C495 except that test specimens shall not be oven dried prior to compressive testing. (3″ × 6″ cylinders are recommended). **Class I, II, and III ELASTIZELL EF require special handling and testing techniques. Contact the Elastizell Corporation for these procedures.**

6. SPECIAL CONSTRUCTION METHODS:

Installation procedures may vary according to the particular design requirements. **Contact the Elastizell Corporation of America for design assistance and application recommendations.**

BASIC PHYSICAL PROPERTIES

ELASTIZELL EF (Engineered Fills)

**Greater values may be obtained if required per Elastizell Corporation design.*

CLASS	MAXIMUM CAST DENSITY pcf	MINIMUM COMPRESSIVE STRENGTH psi*	ULTIMATE BEARING CAPACITY Tons/sf
I	24	10	0.7
II	30	40	2.9
III	36	80	5.8
IV	42	120	8.6
V	50	160	11.5
VI	80	300	21.6

Please contact the ELASTIZELL CORPORATION OF AMERICA for additional specific design values and more detailed specifications.

SPECIALTY CONCRETE CONTRACTORS
CELL-CRETE CORPORATION
ENGINEERED FILL

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OREGON: Oregon City, OR • (253) 358-5978