

A/A-12-B CSI-DIV. 7

PENGAD-Bayonne,NJ

PLAINTIFF'S
EXHIBIT

BEA-6

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KOPPERS

1968

WATERPROOFING & DAMPPROOFING

MANUAL FOR ARCHITECTS/
ENGINEERS/CONTRACTORS

KOPPERS

Architectural and
Construction Materials

A/A-12-B CSI-DIV. 7

SC-BE-05687

KOPPERS COAL TAR MEMBRANE

Why Coal Tar Materials Should be Used

The function of waterproofing and dampproofing is to prevent the entry or passage of water through masonry or concrete structures. The most important property that must be possessed by any waterproofing or dampproofing material is its ability to resist prolonged contact with water. It cannot be assumed that all materials used for this work are actually resistant to water. True water-resistance is obtained with coal tar pitches.

Advantages of Coal Tar

The following properties of coal tar make it particularly adaptable for waterproofing and dampproofing:

Resistance to Water

The molecular structure of its constituents accounts for the ability of coal tar to withstand and remain virtually unaffected by water even under prolonged immersion.

Resistance to Bacteria

Recent field and laboratory studies show that soil bacteria seldom, if ever, attack coal tar pitch, whereas they do attack, and sometimes destroy, other waterproofing materials.

Chemical Inertness

Because of the chemical structure of its constituents, coal tar pitch is inert to the chemicals usually found in soil.

Permanence

Coal tar pitch maintains its physical and chemical properties during long periods of service underground and thereby provides long-term protection when used for waterproofing and dampproofing.

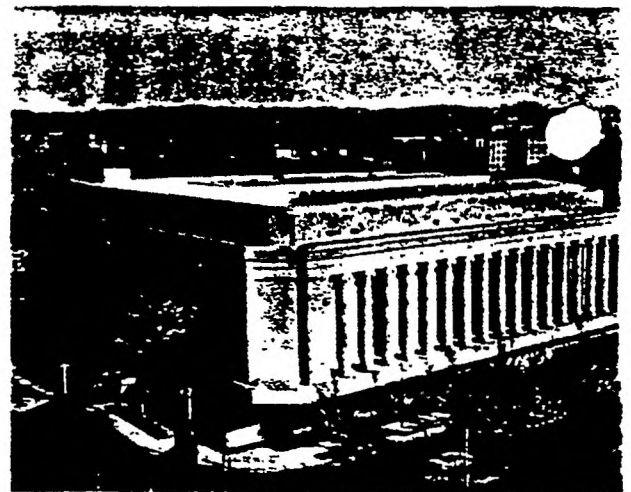
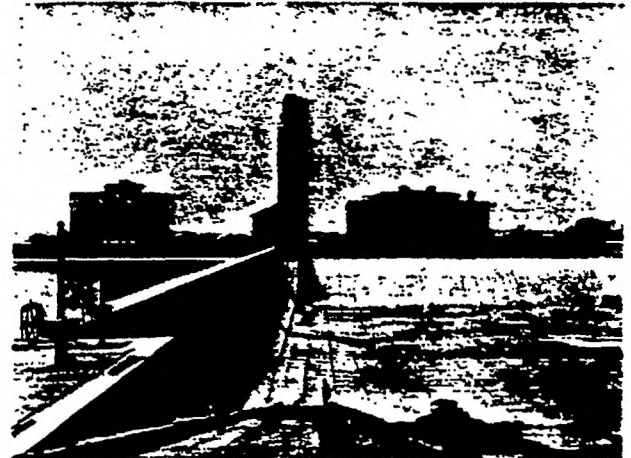
Uniformity

The careful selection, blending and processing of coal tars used in the production of waterproofing pitch and dampproofing products results in the outstanding uniformity of these materials.

Koppers Will Help You With Waterproofing Specifications and Details

Because of the considerable expense and difficulty in rectifying an inadequately waterproofed structure, the specifier must take precautions in the preparation of waterproofing specifications and related details to maximize the possibilities of a permanently water-tight job. The majority of projects present such a wide variety of conditions that the specifications and details must be tailored almost invariably for the individual structure. It cannot be stressed too strongly that an adequate number of plies and the correct combinations of waterproofing materials together with accurate and clear detailing are essential. Koppers has had many years experience in the waterproofing field and offers the specifier engineering assistance in achieving the best possible waterproofing job.

WITHSTANDS THE TEST OF TIME . . .



THE NEED FOR WATERPROOFING

Water in contact with masonry structures is absorbed by capillarity due to the presence of pores and voids existing throughout the mass. Masonry structures that extend below water level (either river, sea or ground water) in addition are subjected to a pressure of the water above; this actually forces water into the pores and voids of the masonry surfaces. This pressure is termed hydrostatic pressure; the deeper the structure extends below the water level, the greater the hydrostatic pressure at any point.

The presence of water in masonry structures may cause damage in a number of ways. Freezing water expands and causes concrete to crack. Chemical containing waters attack concrete and weaken it and eventually may cause corrosion of reinforcing steel. The passage of water through concrete also removes certain constituents which weaken it.

Hydrostatic pressure causes both lateral and upward thrust. Vertical walls must be designed to resist lateral thrust and floors to resist upward thrust. Static water will exert a pressure of 62½ pounds per square foot, 0.43 pounds per square inch, for each foot of head. (See tables on page 12.)

Membrane Waterproofing Method

To effectively prevent the entrance of water under pressure, the time proved method of membrane waterproofing should be followed. When properly applied, membrane waterproofing seals and protects the entire area by forming a con-

tinuous waterproof blanket on the outside surface, through the footings, and over the floor area. Floor waterproofing should be covered with reinforced concrete of sufficient strength and thickness or weight to counteract any expected upward thrust from hydrostatic pressure.

Where and when feasible, an efficient drainage system should be designed and installed to reduce hydrostatic pressure. Water pressure must be relieved during construction by pumping until the masonry structure has developed sufficient strength to overcome both lateral and upward thrust.

In the long run, any concrete or masonry structure will eventually deteriorate to some degree if it is not waterproofed effectively because of the destructive effect of water. The cost of the waterproofing is small in comparison with the total cost of the structure, yet waterproofing prolongs the life of the structure and insures the safety of the investment.

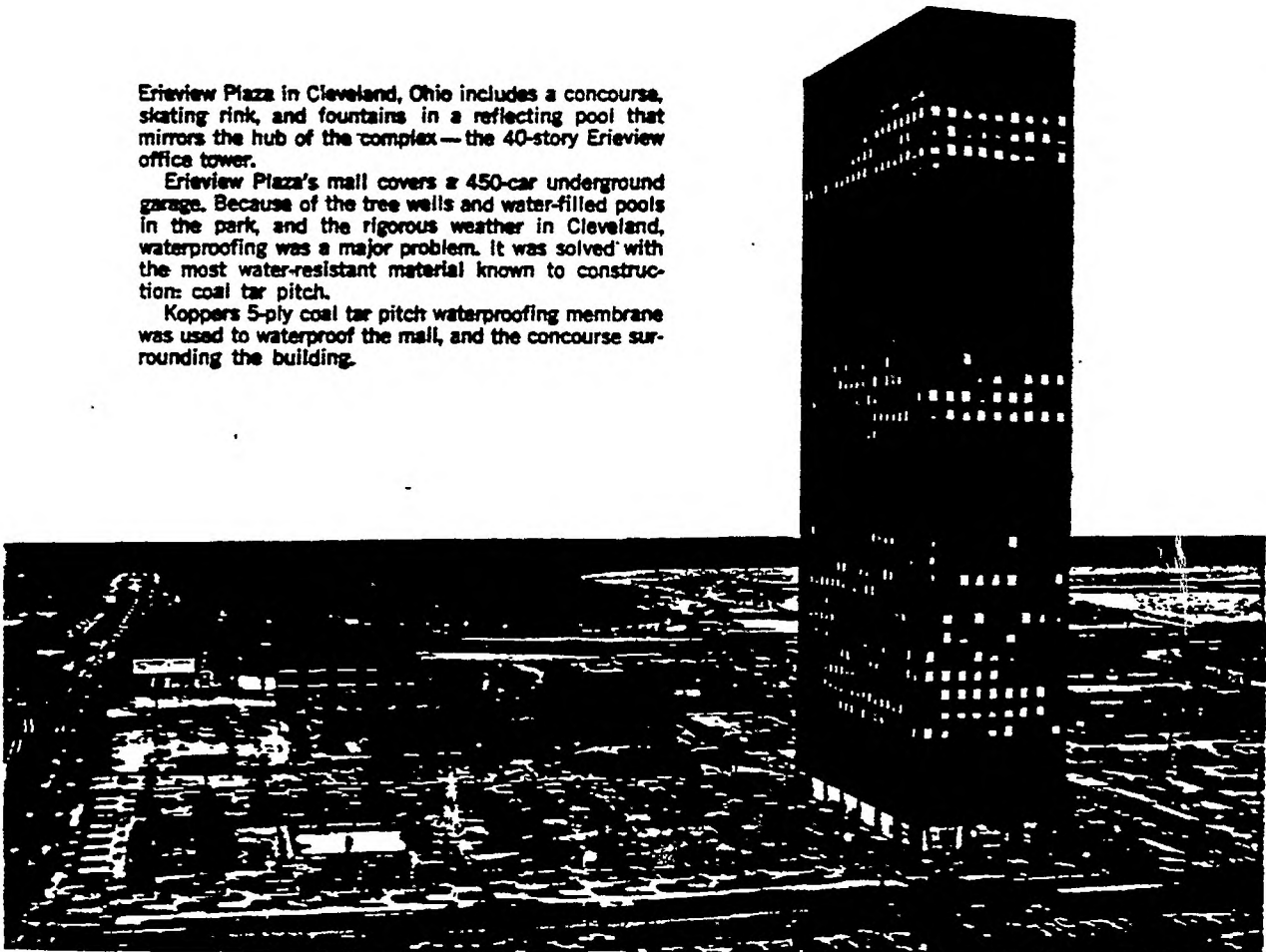
What Does The Waterproofing?

The actual waterproofing provided by a membrane assembly comes only from the amount of coal tar pitch waterproofing agent which is applied between the plies of reinforcement. The purpose of the reinforcement layers is to build up the sufficient amount of pitch to meet the waterproofing requirements of each job and to give strength and flexibility to the membrane itself. The pitch does the waterproofing.

Erieview Plaza in Cleveland, Ohio includes a concourse, skating rink, and fountains in a reflecting pool that mirrors the hub of the complex—the 40-story Erieview office tower.

Erieview Plaza's mall covers a 450-car underground garage. Because of the tree walls and water-filled pools in the park, and the rigorous weather in Cleveland, waterproofing was a major problem. It was solved with the most water-resistant material known to construction: coal tar pitch.

Koppers 5-ply coal tar pitch waterproofing membrane was used to waterproof the mall, and the concourse surrounding the building.



THE NEED FOR DAMPPROOFING

Dampproofing is a water-repellent surface coating applied by mop, brush, spray or trowel and should only be used where there is no hydrostatic pressure against the surface. Waterproofing is dampproofing but dampproofing is not waterproofing. Dampproofing becomes ineffectual when cracks develop in masonry structures from settlement or other causes. If the earth surrounding the foundation walls holds water for any length of time, moisture will penetrate the masonry structure because of its porosity. Mortar averages about 15 to 20% voids and concrete about 13 to 17%. A good dampproofing coating will penetrate into and fill the pores of a surface. It is sufficiently elastic to resist minor expansion and contraction and is unaffected by weak acids and alkalis that may come in contact with it.

Dampproofing must be applied in a sufficient number of coats to provide a film free of pinholes. It must have a strong bond with the surface to which it is applied to insure that it will remain in place. Dampproofing should not be applied to a masonry surface which may be saturated with moisture and also subject to freezing and thawing.

Through-Wall Flashing

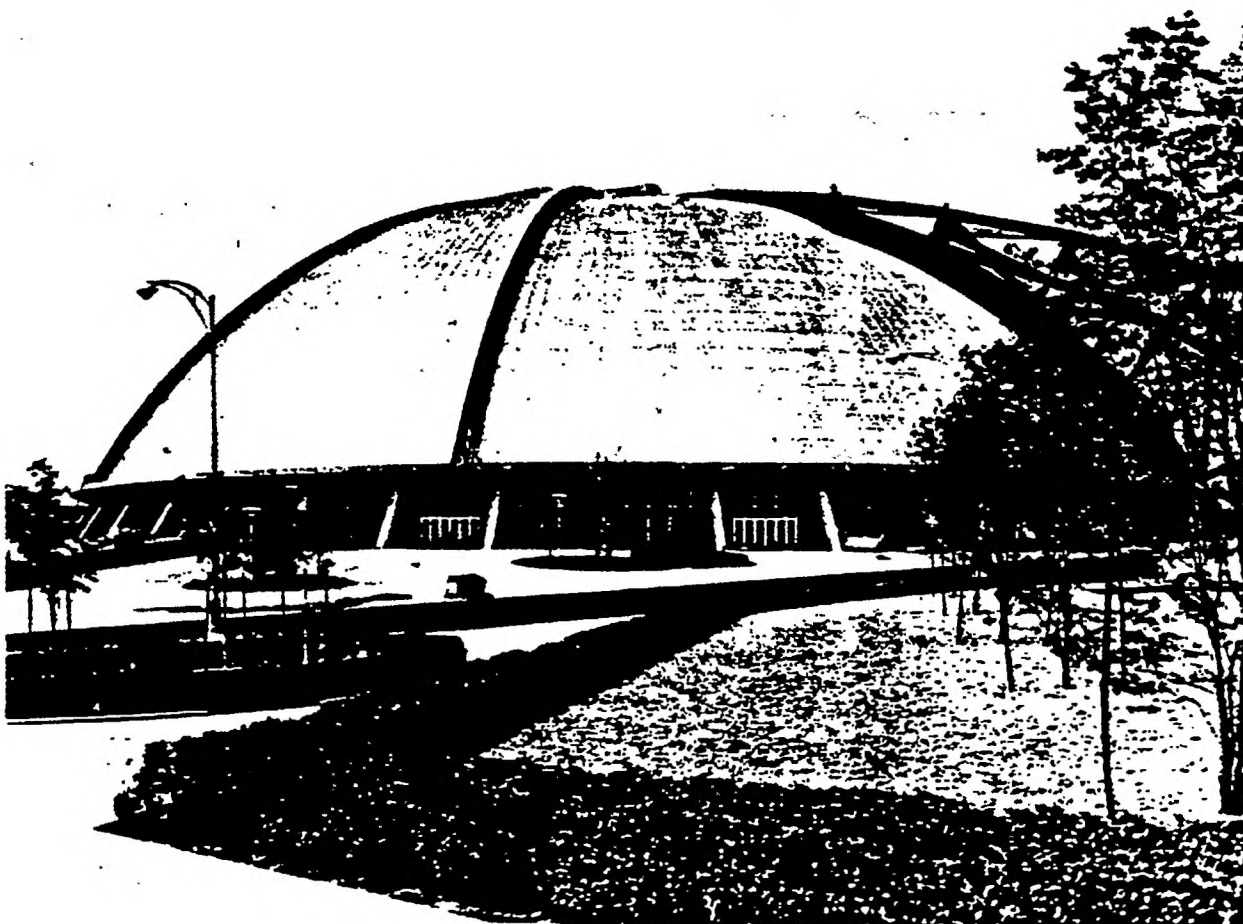
Through-wall flashing, employing fabric embedded in a flashing cement, is designed to prevent the penetration of intermittently present water through a wall or similar construction by diverting the direction of flow. It is essentially the same as dampproofing in principle, but differs in that dampproofing is generally an all-over surface treatment, while through-wall flashing is restricted to vulnerable points.

A 50-foot-wide, open promenade deck, encircling the base of Pittsburgh's new stainless steel dome Civic Arena, designed by Mitchell & Ritchey, architects, serves a dual role as walkway and roof. Better than two-thirds of the promenade area functions as a roof over the lower-level entrances, meeting rooms and storage areas.

The walkway-roof has been waterproofed in a time-proven roofing formula by application of a multi-ply

"membrane" of coal-tar pitch and tar-saturated fabric, so that the rooms below will remain bone-dry in all kinds of weather. The waterproof membrane consists of five layers of pitch, and two plies each of tar-saturated felt and cotton fabric.

The 60 tons of coal-tar pitch required for the waterproofing system was supplied by Koppers Company, Inc.



MATERIALS

COAL TAR WATERPROOFING PITCH



Koppers coal tar Waterproofing Pitch is manufactured by distilling selected blends of high-temperature coke oven tars to the proper consistency for waterproofing applications. The pitch produced is resistant to attack by termites, is self-healing and self-sealing if slight breaks occur in the pitch. It conforms to irregularities in the surfaces to be waterproofed and bonds permanently to properly prepared masonry surfaces.

Koppers Waterproofing Pitch complies with A.S.T.M. specification D-450 Type B and Federal Specification R.P.-381 Type II.

Koppers Waterproofing Pitch is furnished in 400-500 lb. drums. It is available also in hot liquid form should the waterproofing project be of sufficient size for this type of delivery.

Field Identification of Pitch and Asphalt
It is often difficult to tell whether coal tar pitch or asphalt has been delivered to a job. Both are dark brown to black in color and are handled in a similar manner. The following are a few simple tests which can be used in the field to assist the specifier or engineer to differentiate between the two products:

Pitch

Bituminous coal derivative
Won't quickly dissolve or discolor gasoline
Will sink in 16% salt water solution
Specific gravity in 1.25 range
Shipped in light metal open top drums

Asphalt

Petroleum derivative
Will quickly dissolve in and discolor gasoline
Will float in 16% salt water solution
Specific gravity in 1.0 range
Usually shipped in paper cartons

REINFORCEMENTS

Architects and engineers have long realized that waterproofing compounds themselves are highly water-repellent, but do not remain in place if applied alone. A supporting framework adds strength and flexibility to the waterproofing agent and provides the means for specified quantities to be built-up in place. It is only logical to use the best reinforcement to produce the best membrane.

SELECTION OF REINFORCEMENT

There are three basic reinforcement products used in standard waterproofing membranes, GLASFAB®, saturated cotton fabric, and felt. The choice of reinforcement member depends on several factors which must be evaluated against the requirements of each specific job. Since all three products have been used extensively over the years with success, select the reinforcement which best meets the requirements of job site conditions, expected hydrostatic pressure, type of surface, severity of environment, potential future movement, value of structure and contents to be protected, and economics.

GLASFAB

GLASFAB is a lightweight, very high-strength, open-mesh, woven-glass fabric which, when combined with applications of waterproofing pitch, forms a tough, monolithic waterproofing membrane. It has greater strength and resistance to puncture than felt and is especially effective where vibration or deflection may be encountered. It lends flexibility to the membrane and conforms to the contours of the surface over which it is applied. GLASFAB is particularly recommended in waterproofing systems under heavily-loaded columns, for machine and railroad track isolations, in buildings, as well as for bridges, roadways, tunnels, underground garages, parking decks, planter boxes, reflecting pools, etc. It can be applied on corners, angles, and irregular surfaces without entrapping air, thus creating a stronger bond.

FABRIC

For years, saturated cotton fabric has been a standard reinforcement product for waterproofing membranes. It has certain characteristics which are particularly adaptable to membrane applications such as open mesh construction, flexibility and conformance to the contours of the substrate.

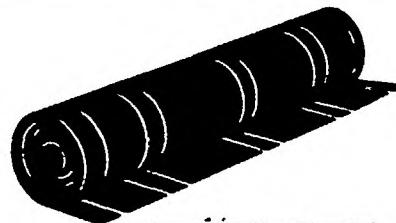
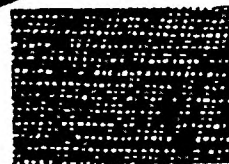
FELT

Felts have been used for many years and perform satisfactorily as reinforcement for waterproofing membranes. Tanned felt in combination with alternate layers of waterproofing pitch forms an effective membrane. Combinations of felt and GLASFAB or fabric are sometimes used in alternate plies. Alternately, felt may be used in the underlying plies with GLASFAB or fabric in the outer plies.

GLASFAB



A strong durable reinforcement. Note open weave and flat fibers of GLASFAB for ease of bitumen penetration resulting in monolithic construction.



GLASFAB is a woven glass reinforcing fabric, which is coated with a specially formulated hydrocarbon resin suitable for use with all waterproofing materials.

- made of 100% textile glass yarn, inorganic and rot proof.
- extremely high and permanent tensile strength.
- maximum resistance to acids and high temperatures.
- open mesh weave, eliminating moisture or air entrapment.
- tough puncture and impact resistance.
- resistance: loom-woven uniformity which gives dimensional stability.
- minimum thickness, giving high flexibility, trim laps, greater volume of bitumen per square without sagging.
- low overall cost because the first cost is the last cost.

STANDARD ROLL

Size
width 36 in.
length 150 ft.
Weight 8 lbs.
Breaking strength
(by grab method)
warp 75 lbs.
fill 75 lbs.

180° in one direction and then through 360° over the same mandrel in the opposite direction.

Color: Black
Thread count: 20 x 10
Also available: Thread Count—
20 x 20
and 10 x 10.

Flexibility

No cracking of the uncoated fabric when at 32°F, it is bent over a $\frac{1}{4}$ " mandrel through an arc of

GLASFAB is made to comply with A.S.T.M. Specification D-1668 and Federal Specification HH-C-466b.

TAR SATURATED COTTON WATERPROOFING FABRIC

Tar Saturated Cotton Waterproofing Fabric, an open-mesh cotton fabric, is thoroughly saturated with coal tar pitch by being passed successively through hot melted pitch and hot squeeze rolls during its manufacture. It is sufficiently porous to permit the moppings of hot Waterproofing Pitch to penetrate through during the application of the waterproofing and become firmly anchored in place. Tar Saturated Cotton Fabric is manufactured in the following grades: Standard Grade—a high-quality, saturated cotton waterproofing fabric with good tensile strength and a thread count of 28 x 18.

Specification Grade—a superior cotton waterproofing fabric which is made to comply with A.S.T.M. Specification D-173, Federal Specification HH-C-581a and HH-C-591.

TARRED FELT

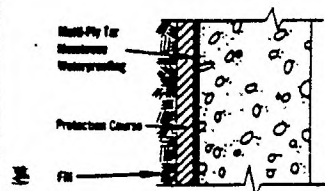
Approved Tarred Felt is a product of the "felting" of organic fibers.

The dry felt is passed through a hot bath of coal tar and hot squeeze rolls. Koppers tar saturated felt increases in weight not less than 140% during saturation. The felt most frequently used in waterproofing applications has a minimum weight of 13 pounds per 100 square feet or a minimum weight of 56 pounds per roll of 432 square feet.

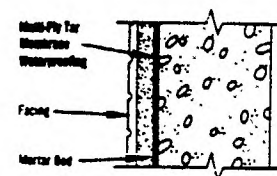
Approved Tarred Felt is made to comply with A.S.T.M. Specification D-227 and Federal Specification HH-R-595.

Protection Course

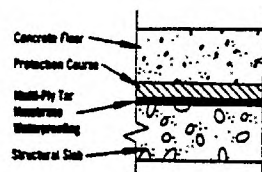
A newly applied waterproofing membrane must be protected against rupture and puncture during backfilling or construction. In all cases, backfilling should be done as soon as possible to further protect the membrane.



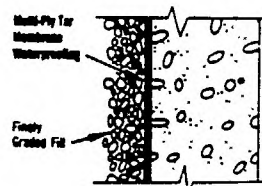
Impregnated building board or impregnated rigid insulations serve as good protection course materials for the average application.



A course of cement concrete applied against the waterproofing can be used as a bedding course for brick, tile, or other protective facing in applications such as swimming pools, shower baths, dairy and hotel kitchen floors.



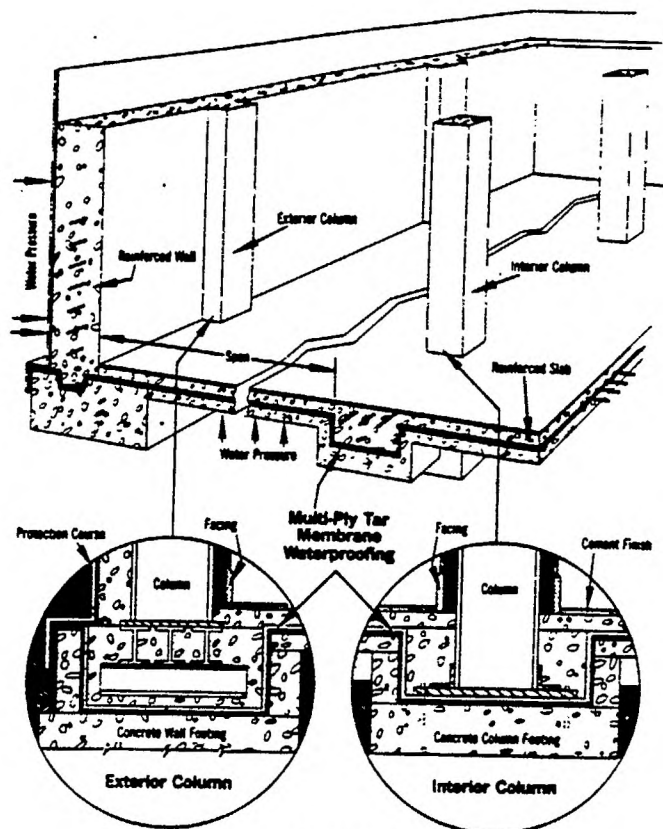
Waterproofing may be protected by a slab of concrete in tunnels, subways, sidewalk vaults, sub-basements and reservoirs.



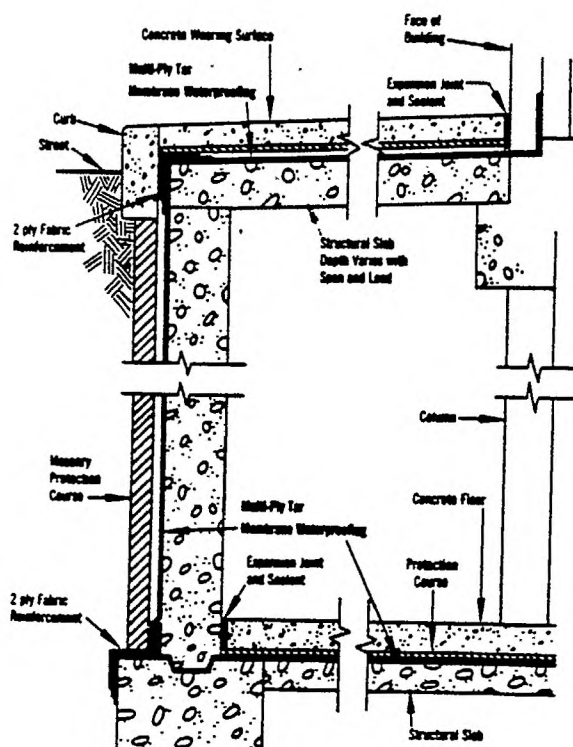
Protection course can be omitted on culverts and bridge arches providing a uniformly fine fill, free of cinders and sharp stone, is available to be placed directly against the waterproofing.

DETAILS

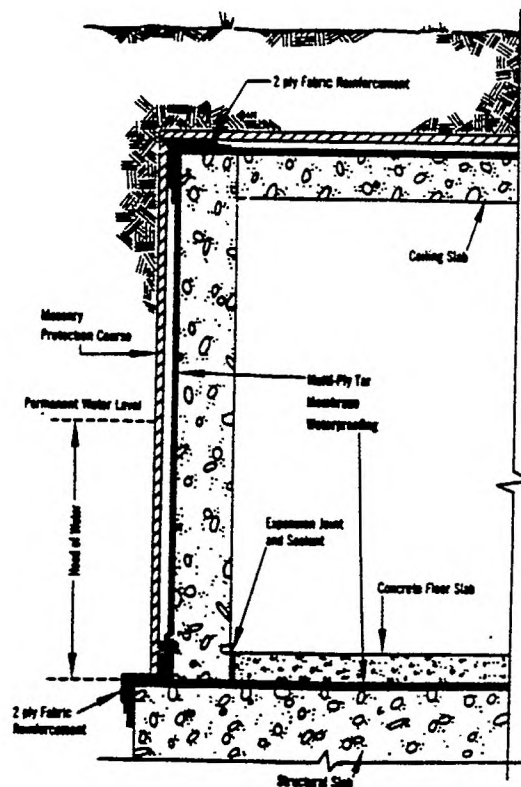
Careful detailing, particularly in the critical areas of a structure, is essential to achieve a watertight job. The following pages contain suggested methods of handling the details for typical critical areas encountered in sub grade waterproofing. It is recognized that many jobs have their own particular set of conditions which often require special detailing. The following group of details by no means illustrates the only methods for a given situation but are shown as details which have resulted in successful applications over the years.



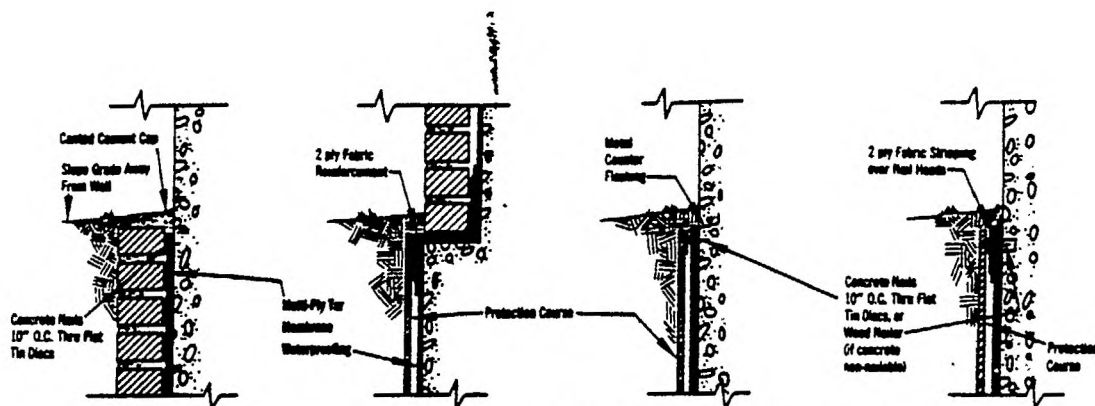
FOUNDATION WATERPROOFING
NO SCALE



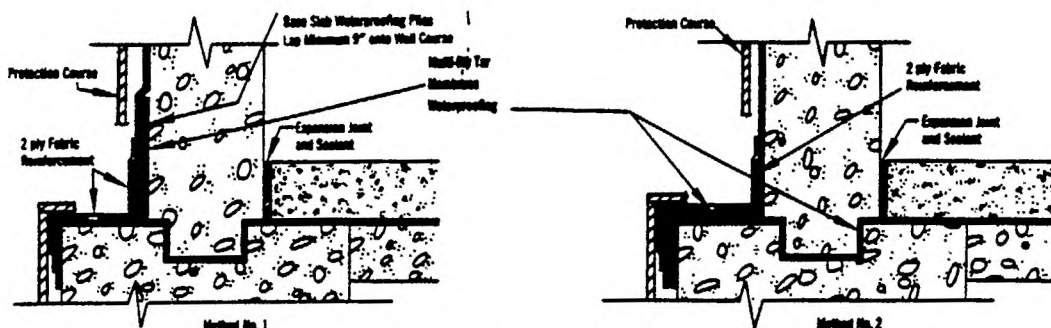
SIDEWALK VAULT
 $\frac{1}{2}" = 1'-0"$



TUNNEL
 $\frac{1}{2}" = 1'-0"$



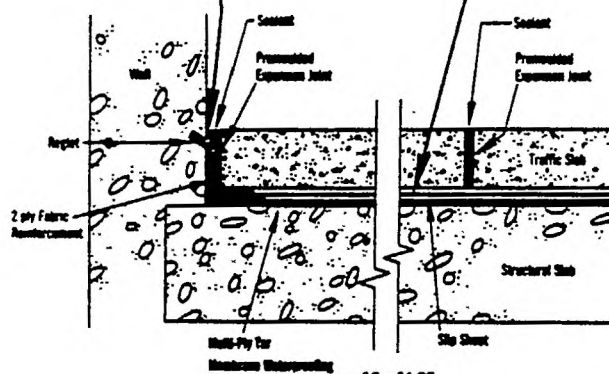
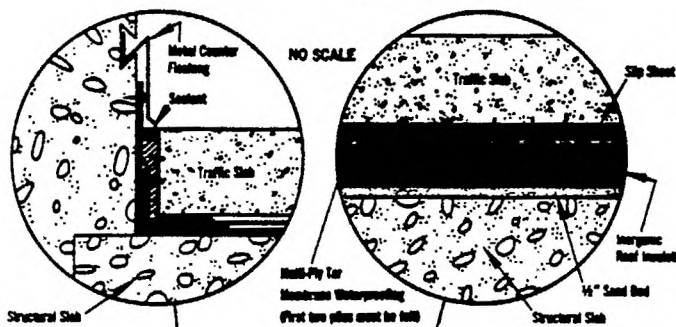
TERMINATIONS OF MEMBRANE AT GRADE 1"=1'-0"



MEMBRANE THRU KEY JOINT 1"=1'-0"

Alternate Flashing Method

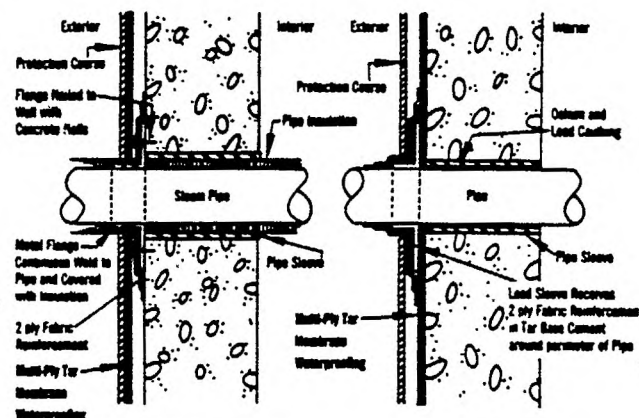
Alternate Waterproofing Method (When Insulation is Required)



WATERPROOFING BETWEEN SLABS

(When Bituminous Paving is used no expansion joint is necessary)

In waterproofing applications between slabs where a possibility of movement exists introduce a slip sheet or anti-bonding element on the top surface of the waterproofing membrane. This permits the top or exposed slab to move without damaging the membrane beneath it. A tough building paper impervious to bituminous material, heavy polyethylene sheet, heavy coated roofing felt, rigid non-absorbent insulation, a minimum 1/2 inch sand bed or a combination of such materials are some of the materials which make suitable slip sheets or anti-bonding elements.



INSULATED STEAM PIPE DETAIL

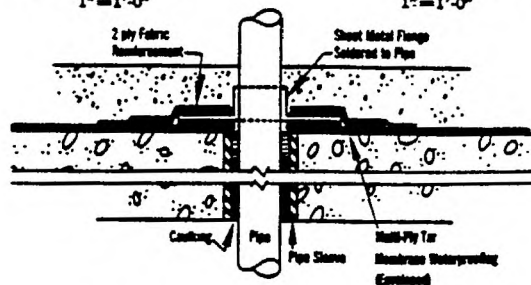
Thru Foundation Wall

1"=1'-0"

PIPE DETAIL

Thru Foundation Wall

1"=1'-0"



PIPE DETAIL THRU HORIZONTAL SLAB

1"=1'-0"

specifications

MEMBRANE WATERPROOFING

The waterproofing specifications on these pages are based upon many years of technical and practical experience. They are presented in the accepted CSI (Construction Specifications Institute) form for the convenience of the specifier.

The methods of application are in accordance with accepted standard practice. The materials recommended have been designed and tested for the best waterproofing applications.

Under most conditions access to a waterproofing membrane in service is difficult, costly, and sometimes impossible. It is recommended that the specifier seriously consider overspecifying in situations where there is any doubt regarding correct number of plies, layers of pitch and strength requirements in any membrane system.

A thoroughly experienced and reliable contractor is essential for a successful application.

Piles of Membrane Recommended for Different Water Pressures

Based on application to solid wall or floor

head of water in feet	Felt, Fabric, Glasfab or Combined Felt & Fabric	
	plies	pitch moppings
1-3	2	3
4-10	3	4
11-25	4	5
26-50	5	6
51-100	6	7

Pressure in Pounds per Square Inch for Different Heads of Water in Feet

Head, ft.	0	1	2	3	4	5	6	7	8	9
0		0.433	0.866	1.299	1.732	2.165	2.598	3.031	3.464	3.897
10	4.330	4.763	5.196	5.629	6.062	6.495	6.928	7.361	7.794	8.227
20	8.660	9.093	9.526	9.959	10.392	10.825	11.258	11.691	12.124	12.557
30	12.990	13.423	13.856	14.289	14.722	15.155	15.588	16.021	16.454	16.887
40	17.320	17.753	18.186	18.619	19.052	19.485	19.918	20.351	20.784	21.217
50	21.650	22.083	22.516	22.949	23.382	23.815	24.248	24.681	25.114	25.547
60	25.980	26.413	26.846	27.279	27.712	28.145	28.578	29.011	29.444	29.877
70	30.310	30.743	31.176	31.609	32.042	32.475	32.908	33.341	33.774	34.207
80	34.640	35.073	35.506	35.939	36.372	36.805	37.238	37.671	38.104	38.537
90	38.970	39.403	39.836	40.269	40.702	41.135	41.568	42.001	42.434	42.867

Ref. Kidder-Parker Architects and Builders Handbook

Material Quantities (for estimating purposes)

Piles of Koppers Tar Saturated Fabric or approved tar felt	alternate moppings of Koppers Waterproofing Pitch required	pounds of pitch required to complete each 100 sq. ft. of waterproofing
2	3	90
3	4	120
4	5	150
5	6	180
6	7	210

MEMBRANE WATERPROOFING (CSI DIVISION 7)

1. SCOPE

All membrane waterproofing for concrete slabs—vertical and horizontal—where noted on drawings shall be _____ ply membrane waterproofing consisting of _____

2. GENERAL REQUIREMENTS

a. Preparation of surfaces: Surfaces to be waterproofed shall be reasonably smooth and free from holes or projections which might cause puncture of the membrane. The surface shall be dry and thoroughly cleaned to remove dust and loose materials immediately before application of the waterproofing. Do not apply waterproofing where effects of freezing or moisture will adversely affect the waterproofing application.

b. Application: All membrane waterproofing shall be applied by an experienced roofing and waterproofing contractor.

3. APPLICATION PRECAUTIONS

a. Pitch shall not be heated above 375°F.

b. Roll or press firmly all plies of membrane into the hot pitch and apply without wrinkles, buckles or kinks.

c. On vertical walls apply pitch with cotton roller mops or by other suitable application techniques.

d. Lay membranes on vertical surfaces of deep waterproofing surfaces in courses not exceeding ten feet in length where immediate and careful backfilling is not possible. After each course of waterproofing system is completed and before the top mopping is applied, nail each course at the upper edge before the next course is applied. Nail each succeeding course endlapping not less than 10 inches.

e. Reinforce wall angles, corners or any place the waterproofing membrane course may be subject to unusual stresses with not less than 2 additional plies of fabric or GLASFAB reinforcement and moppings of pitch.

f. Insulate and protect all hot water and steam pipes which project through or are near the surfaces to be waterproofed. Take the necessary precautions to prevent water from getting between the waterproofing and the waterproofed surface at all points where the membrane is penetrated by drains, pipes, etc. Apply extra plies of reinforcing membrane and pitch moppings in these areas.

g. Carefully examine laps which have been exposed for any length of time, such as at the junction of a vertical wall and a slab, for defects and insufficient lap areas and repair as necessary before proceeding with further application.

h. Apply all membrane waterproofing systems in a workmanlike manner and use wood nailers treated with a water-borne preservative for all vertical wall waterproofing.

i. Protect the membrane from damage by other trades after installation to maintain the integrity of the waterproofing throughout the structure.

j. Ventilation should be provided in enclosed spaces during application.

specifications

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30	12.990	13.423	13.856	14.289	14.722	15.155	15.588	16.021	16.454	16.887
40	17.320	17.753	18.186	18.619	19.052	19.485	19.918	20.351	20.784	21.217
50	21.650	22.083	22.516	22.949	23.382	23.815	24.248	24.681	25.114	25.547
60	25.990	26.413	26.846	27.279	27.712	28.145	28.578	29.011	29.444	29.877
70	30.310	30.743	31.176	31.609	32.042	32.475	32.908	33.341	33.774	34.207
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b. Roll or press firmly all plies of membrane into the hot pitch and apply without wrinkles, buckles or kinks.

c. On vertical walls apply pitch with cotton roller mops or by other suitable application techniques.

d. Lay membranes on vertical surfaces of deep waterproofing surfaces in courses not exceeding ten feet in length where immediate and careful backfilling is not possible. After each course of waterproofing system is completed and before the top mopping is applied, nail each course at the upper edge before the next course is applied. Nail each succeeding course endlapping not less than 10 inches.

e. Reinforce wall angles, corners or any place the waterproofing membrane course may be subject to unusual stresses with not less than 2 additional plies of fabric or GLASFAB reinforcement and moppings of pitch.

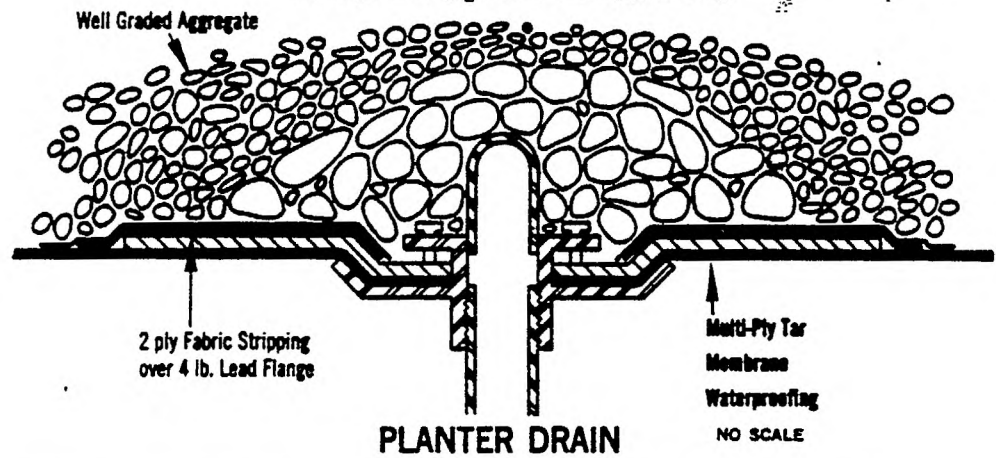
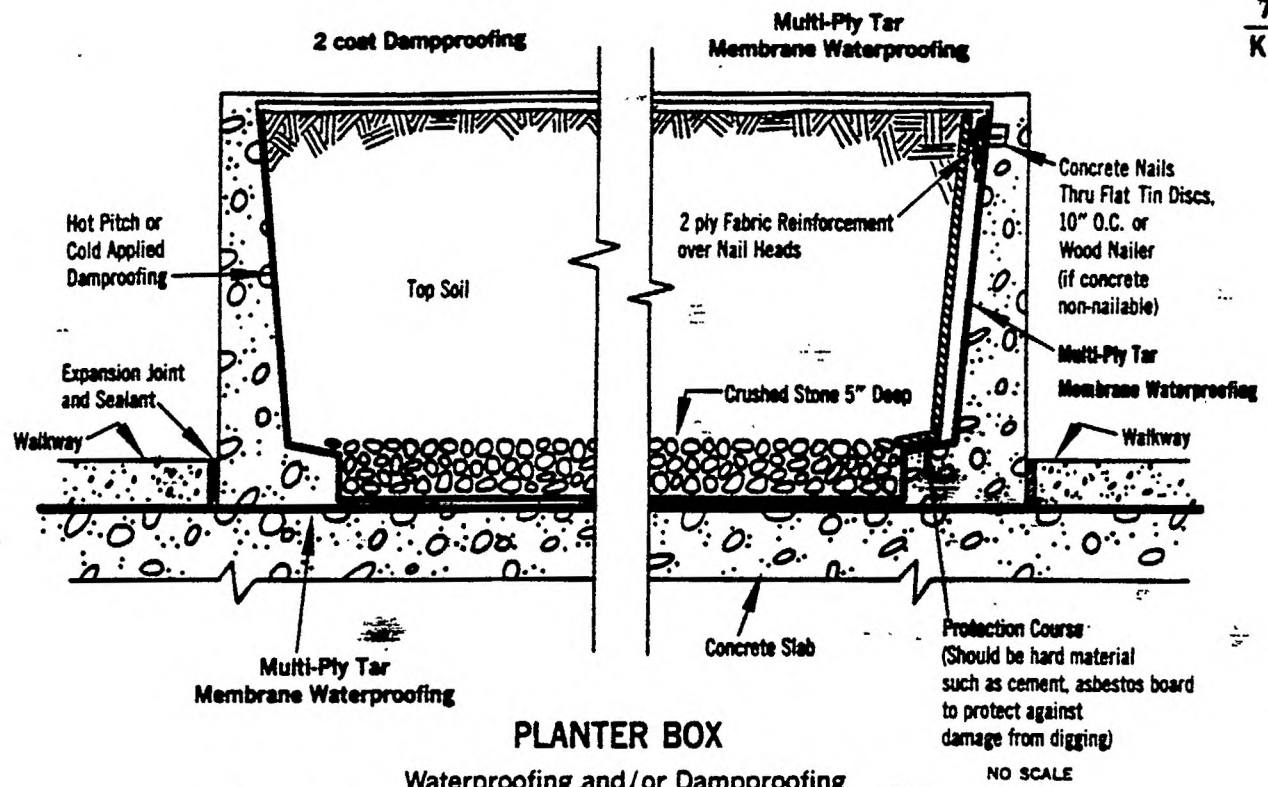
f. Insulate and protect all hot water and steam pipes which project through or are near the surfaces to be waterproofed. Take the necessary precautions to prevent water from getting between the waterproofing and the waterproofed surface at all points where the membrane is penetrated by drains, pipes, etc. Apply extra plies of reinforcing membrane and pitch moppings in these areas.

g. Carefully examine laps which have been exposed for any length of time, such as at the junction of a vertical wall and a slab, for defects and insufficient lap areas and repair as necessary before proceeding with further application.

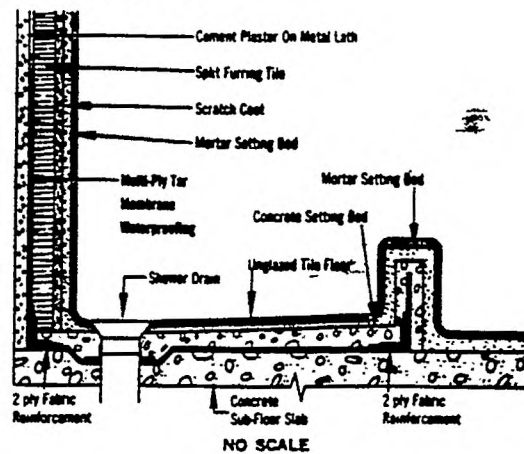
h. Apply all membrane waterproofing systems in a workman-like manner and use wood nailers treated with a water-borne preservative for all vertical wall waterproofing.

i. Protect the membrane from damage by other trades after installation to maintain the integrity of the waterproofing throughout the structure.

j. Ventilation should be provided in enclosed spaces during application.



SHOWER BATH WATERPROOFING



4. MATERIALS

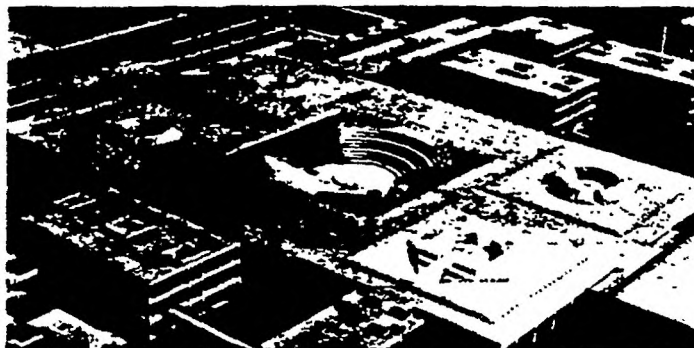
- a. Coal Tar Waterproofing Pitch—A.S.T.M. D-450 Type B
- b. Membrane (Select one or combination)
GLASFAB—A.S.T.M. D-1668
Tar Saturated Cotton Fabric—A.S.T.M. D-173
Approved Tarrd Felt—A.S.T.M. D-227
- c. Concrete Priming Oil—A.S.T.M. D-43-41

5. APPLICATION

a. Horizontal concrete slab: (1) Beginning at the low point of the slab mop the surface with hot Koppers Waterproofing Pitch and immediately apply the reinforcing membrane over the entire area. (2) Be sure that each ply is solidly mopped and bonded. (3) For the various waterproofing systems lap the reinforcing plies as follows: (a) Two Ply System—lap 19 inches. (b) Three Ply System—lap 22½ inches. (c) Four Ply System—lap 27½ inches. (d) Five Ply System—lap 29 inches. (4) Mop the entire top surface with Koppers Waterproofing Pitch. The completed waterproofing forms a firmly bonded system and the reinforcement shall not be exposed at any place. (5) As soon as any portion of the waterproofing has been completed, cover it with the protection course specified, such as brick, tile, concrete rigid insulation or other specified material.

b. Plaza waterproofing: When membrane waterproofing is used in plaza construction with interior drains and finish slab does not rest immediately on the waterproofing, but on concrete pedestals, in addition to the application precautions above the following additional precautions shall be taken: (1) If deck is sloped to interior drains, specify waterproofing pitch conforming to ASTM Specification D-450 Type A. (2) Before the pouring or placing of pedestals supporting precast finish slabs, additional reinforcement shall be installed under each pedestal over existing membrane. (3) Extreme care should be taken to protect the finished waterproofing from damage by other trades during construction of towers, etc. Place a protective course over the finished membrane until the wearing surface is placed. (4) On precast concrete systems all joints should be grouted with flashing cement and stripped.

c. Vertical wall: (1) Over the entire surface to be waterproofed, apply a uniform brush coat of Koppers Concrete Priming Oil, approximately 1 gallon for each 100 square feet. (2) Mop wall completely with Koppers Waterproofing Pitch. (3) Starting at the most practical place, install the desired number of plies lapping them as follows: (a) Four Ply—lap 21½ inches. (b) Three Ply—lap 24½ inches. (c) Two Ply—lap 19 inches. (d) When more than 4 plies are used in a membrane, it is recommended that they be installed in at least two operations, i.e., 2 plies over three, 3 plies over three, etc. maintaining the shingle fashion method in each operation. (4) Nail membrane with concrete nails 8 inches on centers through flat tin discs at the end lap and horizontally across the membrane. If wood nailers are installed, nail membrane to nailer with 1½ inch roofing nails through flat tin discs 8 inches on centers. (5) Mop the entire surface with Koppers Waterproofing Pitch. The completed waterproofing forms a firmly bonded system and the reinforcement shall not be exposed at any place. (6) As soon as any portion of the waterproofing has been completed, cover it with the protection course and backfill.



University of Illinois in Urbana, Illinois—Twenty-two campus buildings are protected from moisture with one-half million square feet of coal tar pitch waterproofing membrane. Fifteen buildings are already constructed including the Lecture Center, library, union complex, science and engineering laboratories, staff and administration building, the physical plant and the Great Court. Seven other buildings are under construction.

Architects for the Chicago Circle, Skidmore, Owings and Merrill of Chicago and architects for the physical plant building A. Epstein & Sons, Inc., Chicago and C. F. Murphy Associates, Chicago, architects for the union building specified 52,500 sq. ft. of 5-ply coal tar pitch membrane to waterproof the area beneath the quadras, multi-level patios surrounding the amphitheater.

In addition 90,000 sq. ft. of coal tar pitch membrane was used to waterproof a maze of 10 foot utility tunnels which connect two physical plant buildings with all academic and administration buildings.



In Los Angeles—The California Federal Plaza building roof serves as a landing spot for helicopters. For waterproofing under the helistop slab, Charles Luckman Associates, architects, selected a Koppers 5-ply coal-tar pitch waterproofing membrane. A similar system protects the 4th floor roof, under a slate promenade. On the ground, twenty large planting boxes are waterproofed with a similar 3-ply built-up membrane covered with ½" insulation for protection from the dirt. Basement walls outside a service and storage area are kept permanently dry with a Koppers system of priming oil plus a 3-ply waterproofing membrane and a top coating of pitch.

specifications

DAMPPROOFING—SUB-GRADE

Three systems are recommended for subgrade dampproofing of masonry surfaces: Pitch Dampproofing (hot applied method), Koppers Foundation Coating (cold applied method), and Bitumastic Super Service Black (cold applied method).

The dampproofing specifications which follow are designed to prevent the penetration of moisture or dampness through a masonry surface. They are not designed to withstand hydrostatic pressures.

Written in the accepted CSI (Construction Specifications Institute) form for the convenience of the Specifier, these

specifications apply to surface above grade as well as below. Materials and methods suggested are designed to keep walls dry. Depending on conditions, dampproof coating applications may be made on either exterior or interior surfaces of reinforced concrete. These treatments also give protection to the reinforcing steel.

Application is of extreme importance and the selection of a reliable contractor is essential for an effective job. Dampproofing will not withstand cracks or other structural failures due to ground movement, settlement or other causes even if it is expertly installed.



DAMPPROOFING SUB-GRADE. HOT PITCH METHOD* (CSI DIVISION 7)

Pitch dampproofing because of the inertness of coal tar pitch, has proved to be highly desirable and is recommended for most dampproofing applications. Where hot applications are not practical, alternative cold applied methods as mentioned above can be used.

1. SCOPE

Foundations, bridge abutments, basements, retaining walls, culverts, reservoirs, dams, sumps, pits, vats, tanks, as noted on drawings, shall be dampproofed by the hot pitch application method using _____ coats.

2. GENERAL REQUIREMENTS

a. Preparation of surfaces: All cracks, holes and voids and open areas in a concrete surface caused by segregation of coarse aggregate shall be thoroughly wetted with water and then carefully filled with Portland Cement Mortar, struck flush and permitted to dry. Before applying dampproofing, the masonry surface shall be free of dirt, grease, excess mortar or other foreign matter that might interfere with adhesion and penetration of the coating.

3. MATERIALS

- a. Coal Tar Waterproofing Pitch—A.S.T.M. D-450 Type B
- b. GLASFAB—A.S.T.M. D-1668
- c. Concrete Priming Oil—A.S.T.M. D-43-41

4. APPLICATION

(a) Over the entire surface to be dampproofed, apply a uniform brush coat of Koppers Concrete Priming Oil and allow to penetrate. Approximately 1 gallon shall be used for each 100 square feet. (b) Apply a mopping of Koppers Waterproofing Pitch. Approximately 25 pounds per 100 square feet shall be used and the pitch shall be melted and heated to a temperature not in excess of 375°F. (c) A second mopping of waterproofing pitch shall then be applied over the entire surface of the first mopping. Approximately 25 pounds per 100 square feet shall be used so that the entire amount of pitch applied shall amount to a total of approximately 50 pounds per 100 square feet. (d) Reinforce all corners, cracks and joints with a strip of GLASFAB or Tar Saturated Waterproofing Fabric, extending 9 inches on both sides, mopped in place. (e) Fabric reinforcing with its pitch moppings shall be in addition to the 2 moppings of pitch. (f) The permanent back-fill shall be tamped into place as soon as the last mopping has cooled.

*preferred method



DAMPPROOFING SUB-GRADE, KOPPERS FOUNDATION COATING (COLD) METHOD (CSI DIVISION 7)

For the prevention of dampness on interior masonry or concrete surfaces below grade, the use of Koppers Foundation Coating, a heavy body coal tar coating, is very effective. Its coal tar base offers protection against moisture and the acids and alkalis found in soil and cinder fill. It can be applied by brush or with regular spray equipment. It penetrates into and bonds tightly to properly prepared masonry surfaces.

1. SCOPE

Foundations, bridge abutments, basements, retaining walls, culverts, reservoirs, dams, sumps, pits, vats, tanks as noted on drawings, shall be dampproofed by the Koppers cold method using _____ coats.

2. GENERAL REQUIREMENTS

a. Preparation of surfaces: All cracks, holes and voids and open areas in a concrete surface caused by segregation of coarse aggregate shall be thoroughly wetted with water and then carefully filled with Portland Cement Mortar, struck flush and permitted to dry. Before applying dampproofing, the masonry surface shall be free of dirt, grease, excess mortar or other foreign matter that might interfere with adhesion and penetration of the coating.

3. MATERIALS

- a. Koppers Foundation Coating

4. APPLICATION

(a) Cover completely the exterior surfaces and footings of foundation walls, retaining walls and bridge abutments with 2 coats of Koppers Foundation Coating applied either by brush or by spray. The application rate is 80-150 square feet per gallon depending upon the porosity of the concrete surface coated. (b) Apply the coating evenly from the footings to the soil or grade level so that all surfaces present a uniform black appearance. Brush or spray the second coat at right angles to the first coat to assure thorough coverage of the entire surface with a continuous impervious film. (c) Drying time between the first and second coats is 24 hours. Back-filling shall not be done before 1 day after the final coat is applied and shall be completed within 6 days.

Chicago Civic Center — C. F. Murphy Associates — Supervising Architects; Skidmore, Owings & Merrill — and Loeb, Schlossman & Bennett — Associate Architects specified 210,000 sq. ft. of 5-ply coal tar pitch membrane to protect the entire Civic Center.

Areas waterproofed include the plaza, air conditioning equipment rooms on the 9th and 31st floors, trucking concourse area and ramps. Approximately 90,000 sq. ft. of waterproofing were used on the dual purpose plaza alone which separates the mass of concrete and bricks which trail from one skyscraper to another. Secondly, the plaza can be used for outdoor functions as rallies, concerts and art exhibits. It includes a pool with fountain, four stairwells, two truck ramps and three 23-foot-square planter boxes.



DAMPPROOFING SUB-GRADE, BITUMASTIC SUPER SERVICE BLACK METHOD (CSI DIVISION 7)

When a heavy duty dampproofing coating is required for severe exposure conditions, Bitumastic Super Service Black provides protection with a very high vapor barrier efficiency. It is a heavy body coal tar base coating applied by brush or special spray equipment. It bonds tightly and does not run or sag on vertical surfaces.

1. SCOPE

Foundations, bridge abutments, basements, retaining walls, culverts, reservoirs, dams, sumps, pits, vats, tanks, as noted on drawings, shall be dampproofed by the Bitumastic Super Service Black cold application method using _____ coats.

2. GENERAL REQUIREMENTS

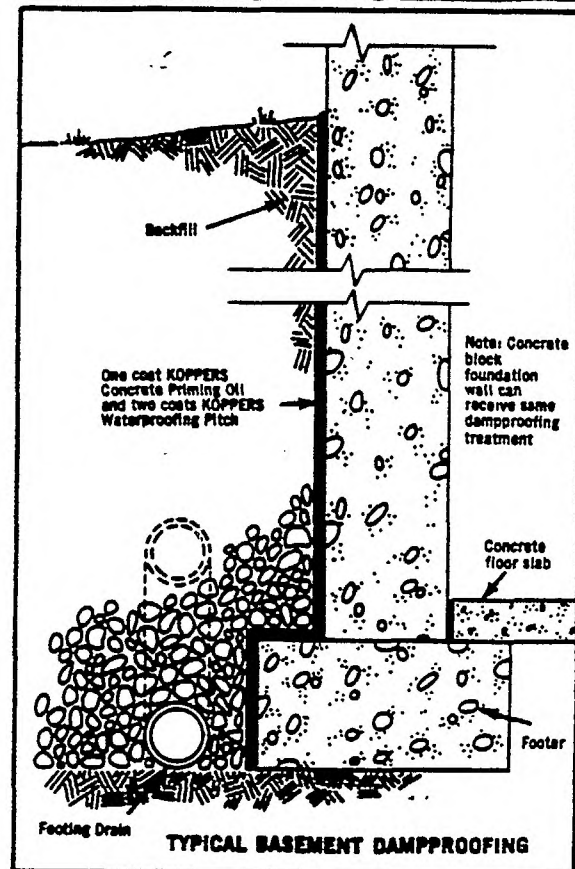
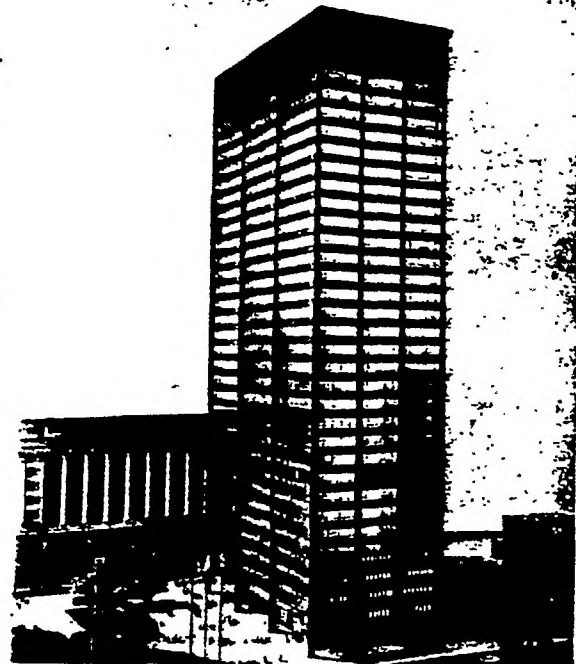
a. Preparation of surfaces: All cracks, holes and voids and open areas in a concrete surface caused by segregation of coarse aggregate shall be thoroughly wetted with water and then carefully filled with Portland Cement Mortar, struck flush and permitted to dry. Before applying dampproofing, the masonry surface shall be free of dirt, grease, excess mortar or other foreign matter that might interfere with adhesion and penetration of the coating.

3. MATERIALS

a. Bitumastic Super Service Black

4. APPLICATION

(a) Apply one coat of Koppers Bitumastic Super Service Black by brush or heavy-duty spray equipment over entire surface to be protected. Apply at a rate of 80 to 100 square feet per gallon. Actual coverage will depend on density and porosity of the concrete. (b) Allow 24 hours drying time. (c) Apply a second coat of Koppers Bitumastic Super Service Black at the rate of 80 to 100 square feet per gallon. (d) Allow a minimum of 48 hours drying time before back-filling. (e) To achieve greater film strength, apply one ply of GLASFAB to the surface immediately before the second application.



WATERPROOFING...AND DAMPPROOFING

USED TODAY

Where waterproofing is critical

SINCE 1917

The Compton Hill Reservoir is one of two reservoirs serving St. Louis, Missouri, and all of St. Louis County. It was built in 1870 with a 56-million-gallon capacity. In 1917, to stop a 3-million-gallon per day leak, a Koppers 5-ply coal tar pitch membrane waterproofing system was installed on the reservoir floor. The reservoir has not been emptied for maintenance since 1917; however, several test borings were drilled in preparation for the construction of Interstate Highway 44, which will be located within 100 to 200 feet of the reservoir and below its floor level. These test borings have indicated no reservoir leakage.

SINCE 1937

Mellon Institute, a non profit institute of industrial research in Pittsburgh, Pa., is completely protected with Koppers coal tar pitch membrane waterproofing system. Over 63 tons of pitch and 84,288 square feet of burlap were required to waterproof the terraces, steps, entrances and sidewalk. The system has been in use since 1937, when the building was constructed.

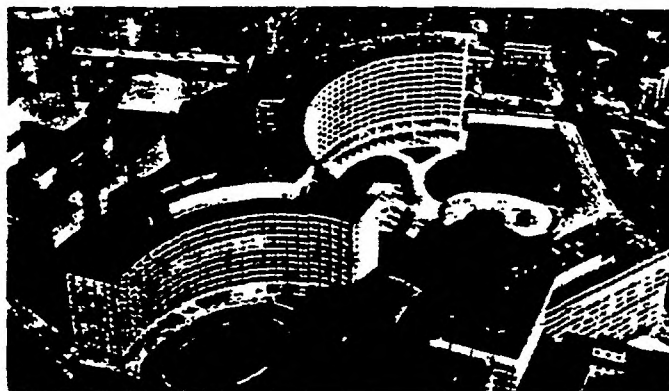
SINCE 1950

Since it was completed in 1950, the Washburn Tunnel in Houston, Texas has been protected with a Koppers coal tar pitch membrane waterproofing system. Approximately 34,000 cars per day travel 2,936 feet from portal to portal without encountering wet spots.



Prudential Center—Boston, Mass.—Better than 350,000 square feet of 3-ply waterproofing membrane, composed of coal tar waterproofing pitch, manufactured by Koppers Company, Inc., and woven glass fabric, was installed throughout Boston's new 52-story Prudential Tower and its adjoining plazas.

The architects, Charles Luckman Associates and Hoyle, Doran & Berry, specified this same protection for waterproofing all comfort facilities and as a complete waterproofing system for the five mechanical floors. This waterproofing system plays a major protective role in the North and South Plazas where decorative fountains, landscaped terraces with golden weeping willows and Japanese holly bushes and a sunken ice-skating rink are special attractions in these areas. (Photo courtesy of Aerial Photo of New England)



One-third of the new Washington Hilton Hotel is underground—and 200,000 sq. ft. of 5-ply coal tar membrane makes it waterproof.

Because no building in Washington, D. C., can be over 90 feet high, William B. Tabler, the architect of the new Washington Hilton Hotel, had to design a structure that would have much usable space underground. The hotel has five levels below grade, including garages, ballroom, dining rooms, lobbies, exhibit space and service space.