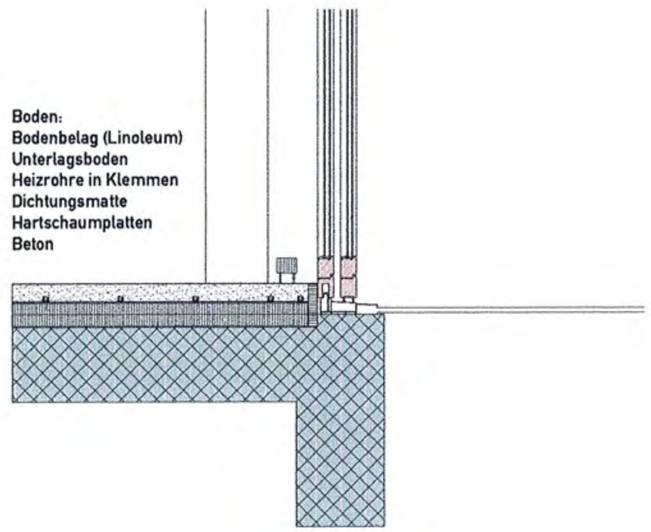
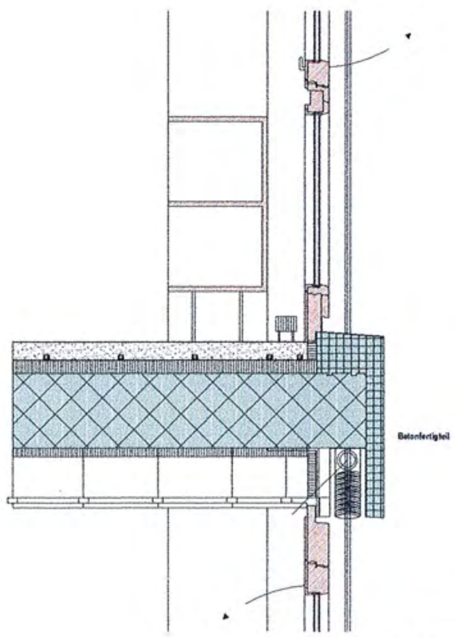
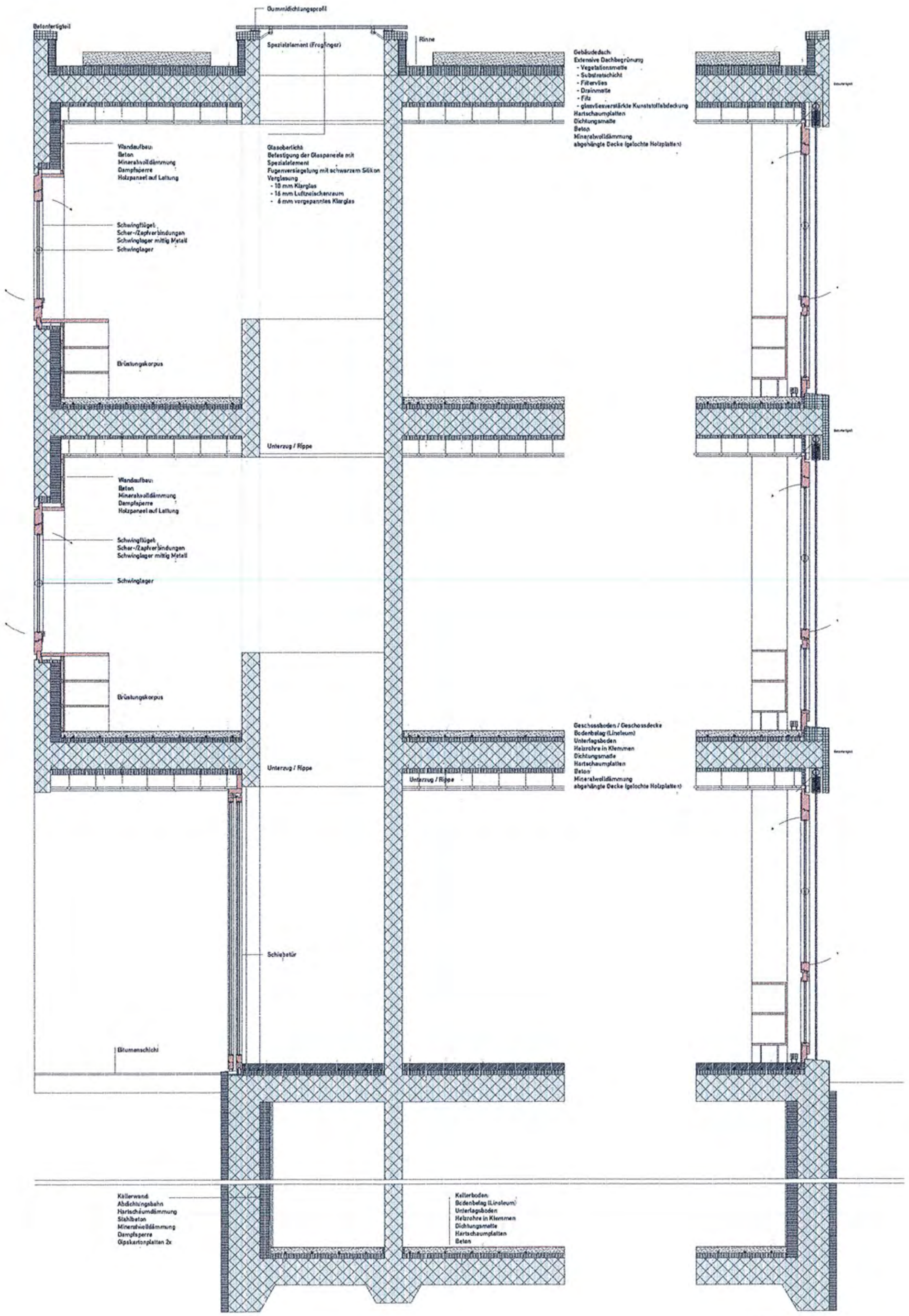
KONSTRUKTIONSPROZESS



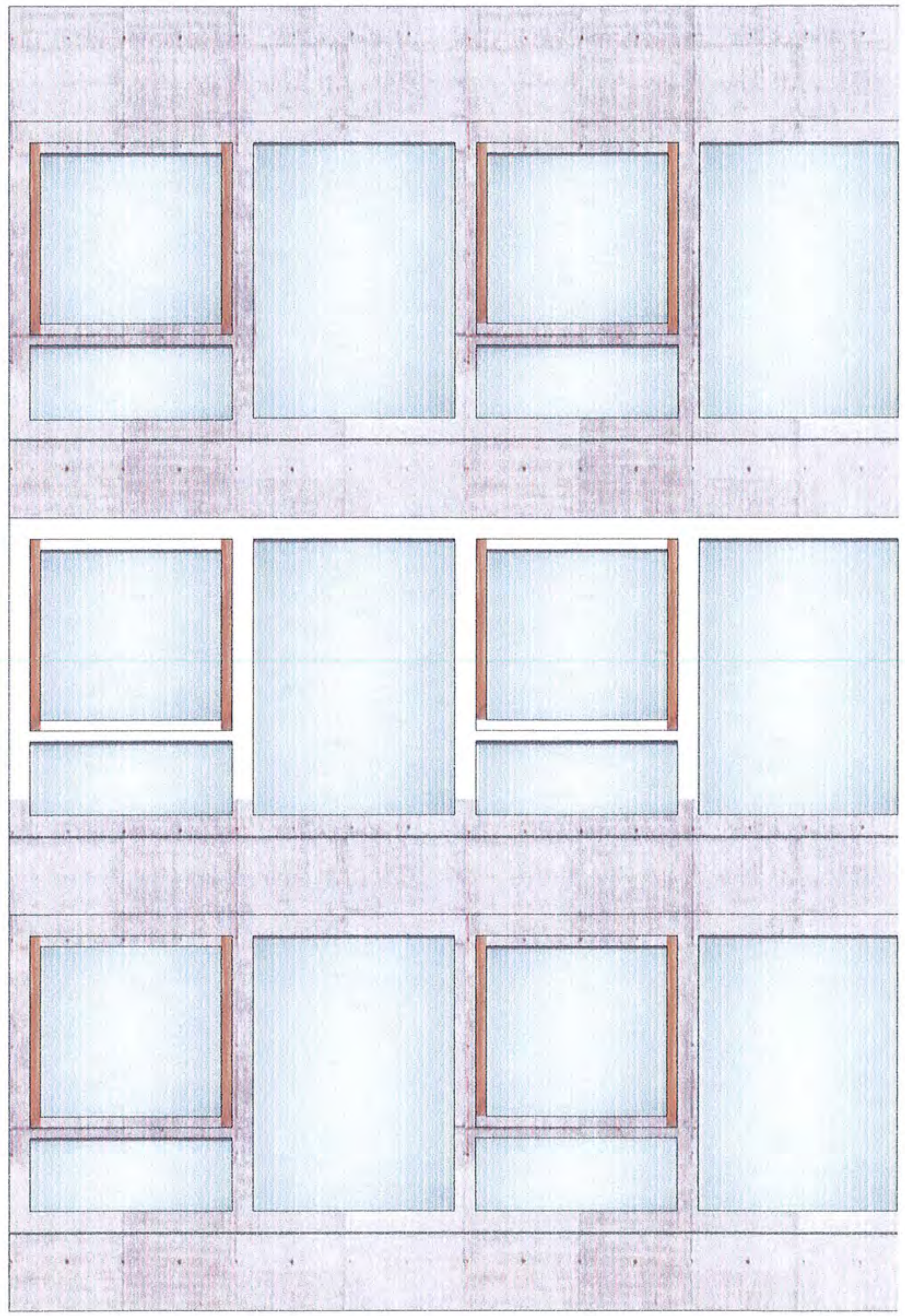
SCHWELLE SCHIEBETÜR 1:10



BRÜSTUNG KLASSENZIMMER 1:10



QUERSCHNITT A-A 1:20



TEILFASSADENANSICHT WEST 1:20

DIPLOMWAHLFACH KONSTRUKTION

DOZ. R. SEILER

Ausgangslage

Im Kontext des durch den Bauboom der 50er Jahre geprägte Schwamedingen soll der Dialog zwischen einer bestehenden Schulanlage und den erweiterten Bedürfnissen der Mattenhof-Schule geführt werden.

Eingebettet in den Grünanlagen und den 3- bis 4-geschossgigen Blockbauten an der leicht ansteigenden Hanglage des Zürichbergs bietet sich ein alltägliches Bild Schweizer städtebaulicher Realität.

Entwurfsansatz

Grundgedanke des Projekts ist die Auseinandersetzung mit dem Alltäglichen und die Schärfung der Sinne für das schon nicht mehr Wahrgenommene, beeinflusst von den eigenen schulischen Erinnerung.

Die Poesie des Alltags, des Normalen, die Herausarbeitung gefundener Qualitäten und Einbettung in die Natur, sind Grundlagen dieses Entwurfes.

Der Vorschlag für die Erweiterung der Mattenhof-Schule als Referenzpunkt des stark zersiedelten Schwamedingen basiert auf räumlicher Verdichtung und Konzentration ohne jedoch Offenheit und räumliche Durchdringung zu verhindern.

Zentral angelegt und Treffpunkt der Schüler ist der Pausenplatz, von dem aus in einer zentripetalen Anordnung die Einbindung und Verankerung in den Kontext stattfindet.

Auf die Topographie des Zürichbergs wird mit einer Sequenz von Terrassen reagiert und deren Verlauf verdeutlicht.

Die neuen Verbindungstrakte unterstreichen den klaren Abschluss zwischen den drei Geländeterrassen und verstärken dadurch deren räumliche und nutzungsmässige Eigenständigkeit. Wege und der Ort werden klar definiert und bilden zusammen eine ausgewogene Einheit.

Ein zentraler Bau entstand bewusst nicht. Ausschlaggebend für die funktionale und räumliche Anordnung der Baukörper ist die intuitive Logik und Selbstverständlichkeit einer schulischen Anlage.

MATERIALKONZEPT UND GEBÄUDEHÜLLE

Die Gesichter der Neubauten werden gezielt sachlich und nüchtern gehalten ohne ein Bild von suggestiver Strenge zu entwickeln.

Die Strukturen generieren eine spielerische Abfolge von Raumsequenzen die durch Licht und Ausblicke Ihre besondere Qualität erhalten.

Eigenständigkeit der neuen Volumen wird durch die klare Volumenausbildung, die Materialwahl und die Textur gebildet.

Sinnliche Erfahrung ohne Überladung werden thematisiert. Der Kontrast zwischen dem glatten, fast schon papierartigen Beton, dessen Erscheinung durch wechselnde Lichtverhältnisse die Wahrnehmung für das Material schärfen, und dem naturbelassenen Holz sollen die Kinder in unaufdringliche Weise haptisch angeregten.

Die Schulhausfassade soll mit ihrem gleichmässigen Rhythmus einerseits Schnittstelle zwischen dem vielschichtigen Umfeld und dem klaren, einfachen Baukörper sein wie auch Schnittstelle zwischen dem Baukörper und seinem vielseitigen Innenleben.

Die Lochfenster sind aus Holz und fassadenbündig im Gegensatz dazu liegen die Raumhohenfenster in den Klassenzimmern um die Lamellenstorenbreite zurückversetzt.

Auf dem Pausenplatzniveau sind sämtliche Verglasungen Raumhoch und an gewissen Stellen, z. B. Mehrzwecksaal mit Schiebetüren zu öffnen.

STATISCHES UND KONSTRUKTIVES KONZEPT

Die Tragstruktur der neuen Gebäude ist aus Sichtbeton, welcher Innen isoliert ist.

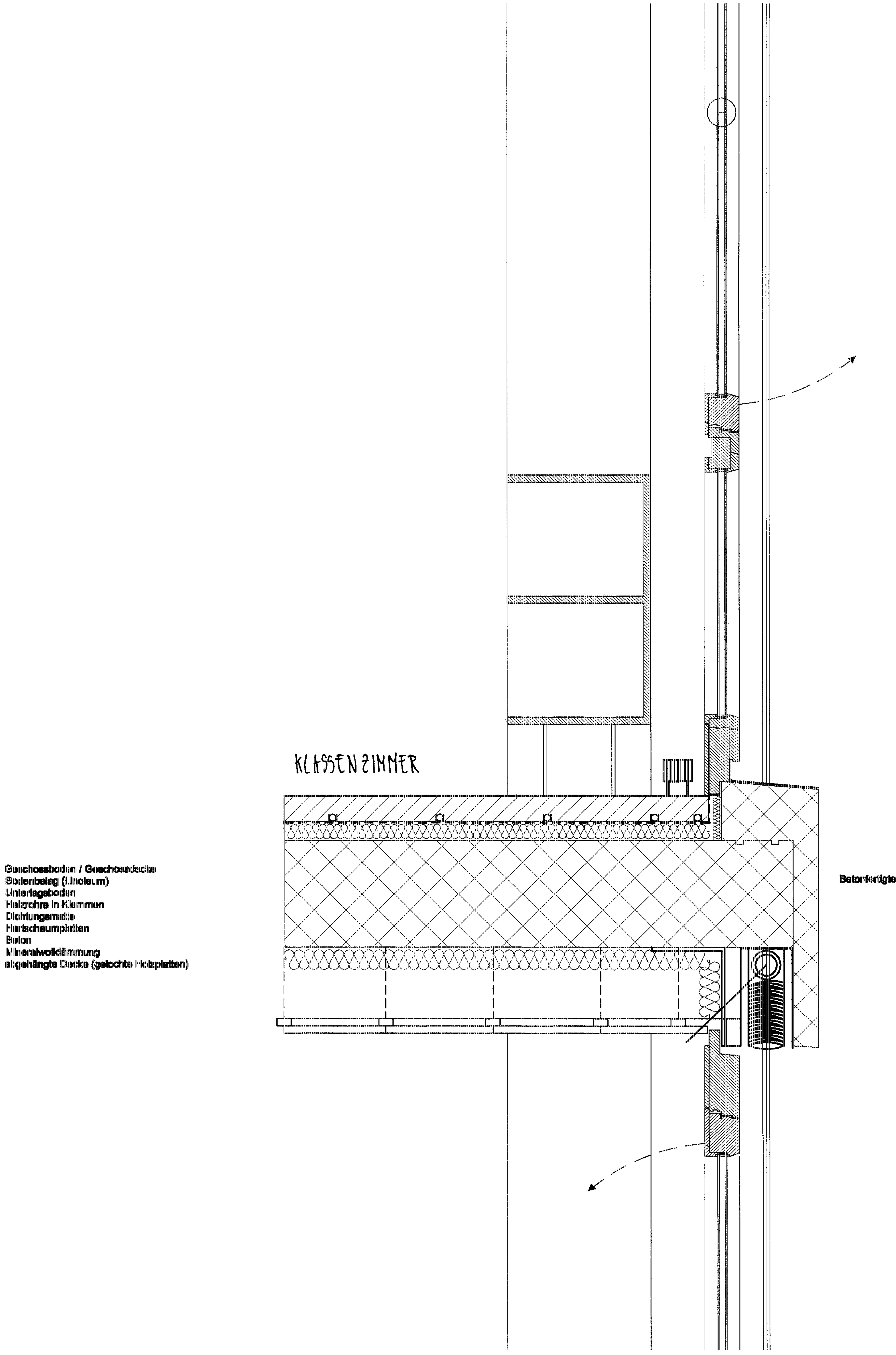
Die statischen Kräfte werden über eine Mischbauweise von Betonschotten und Betonstützen aufgenommen.

Die Betonstützen, die Lammellenstorenblenden, sowie die Brüstungsabdeckungen sind vorfabriziert.

Das Gebäude kann überall, ausser den WC Anlagen, natürlich über Wandfenster oder Oblichter belüftet werden,

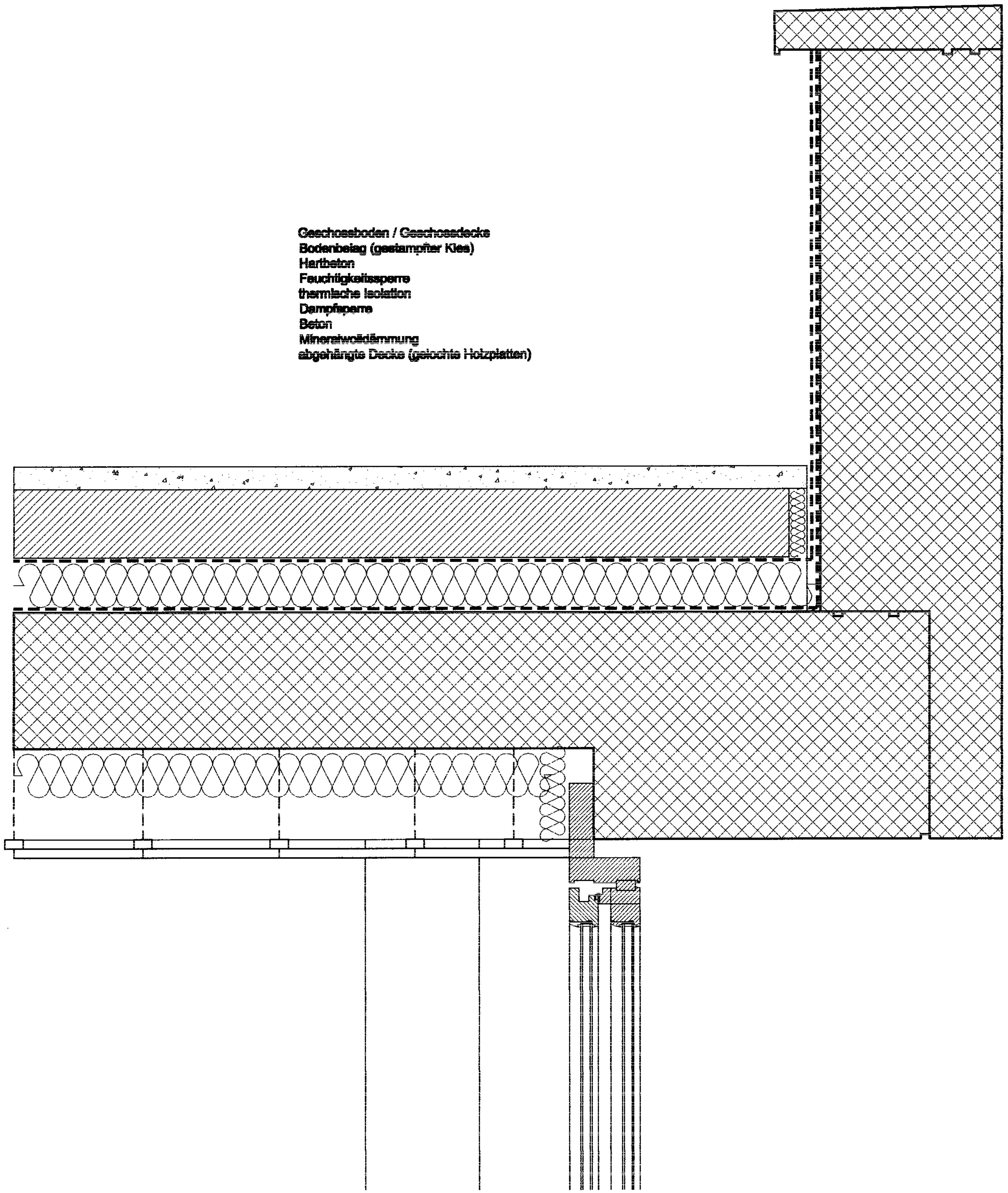
Durch die Auskragung auf der Ostseite des Schulgebäudes entsteht ein gedeckter Aussenbereich und definiert eine Zone zwischen Innen und Aussen. Die Auskragung wird von Unterzügen im Raster von 2.10 m gebildet. Die Galerien sind durch die Betonbrüstungen, welche als Oberzüge wirken, möglich.

Die gedeckten, aber aussenliegenden Pausenhallen schaffen die erwünschte Durchlässigkeit der Anlage und erschliessen die verschiedenen Nutzungseinheiten.

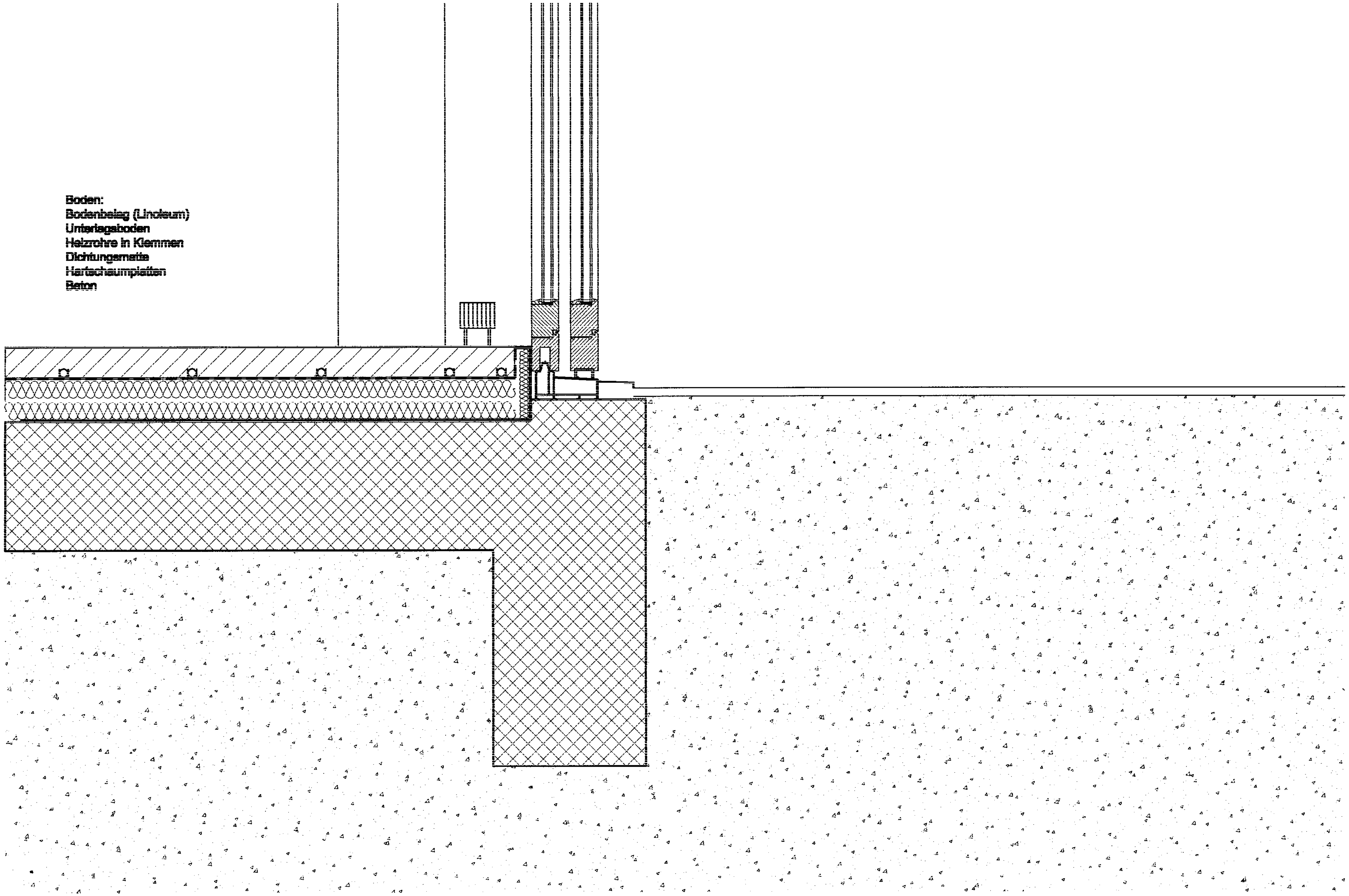


KLASSENZIMMERFASSADE 1:10

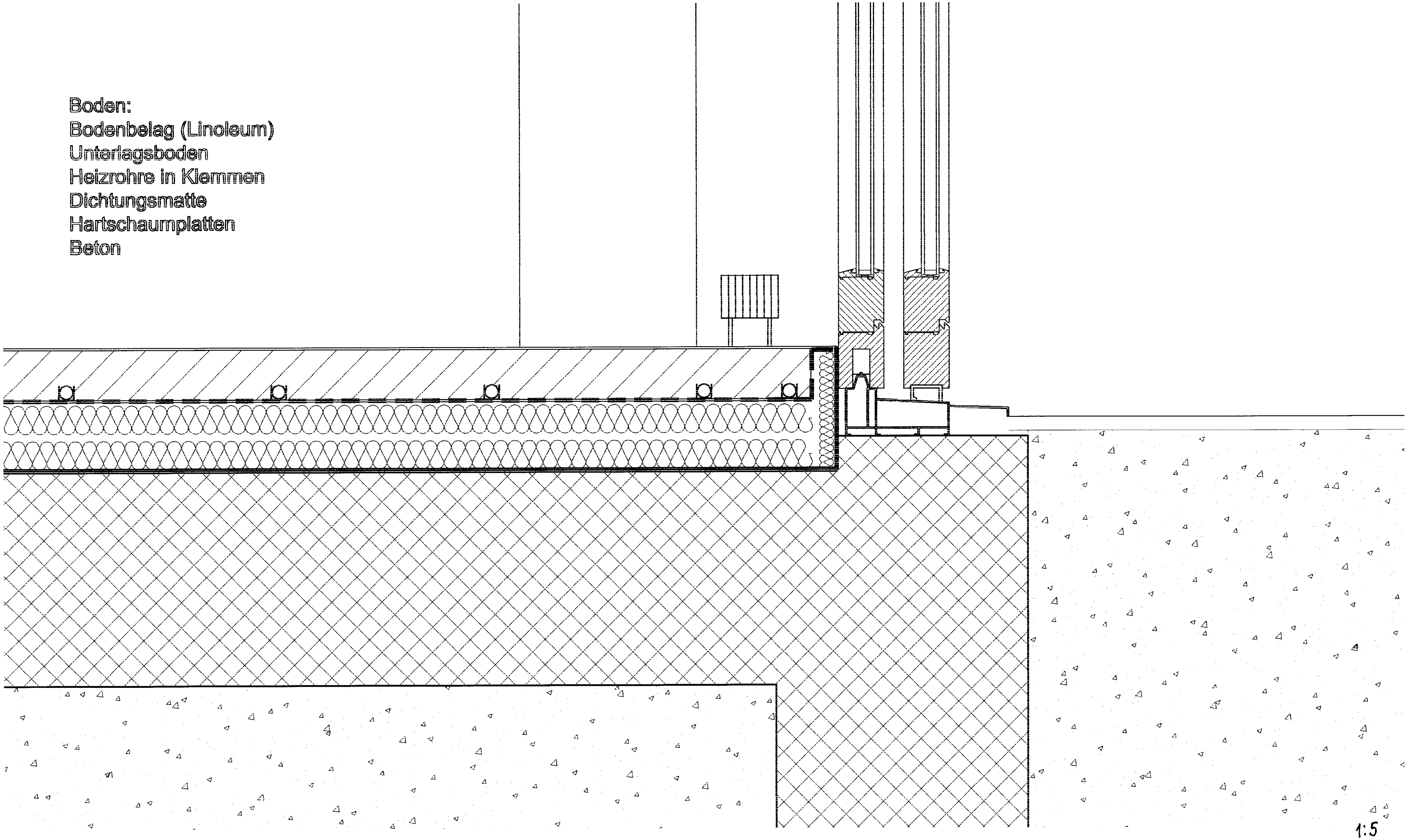
HORTTERASSENABSCHLUSS 1:10

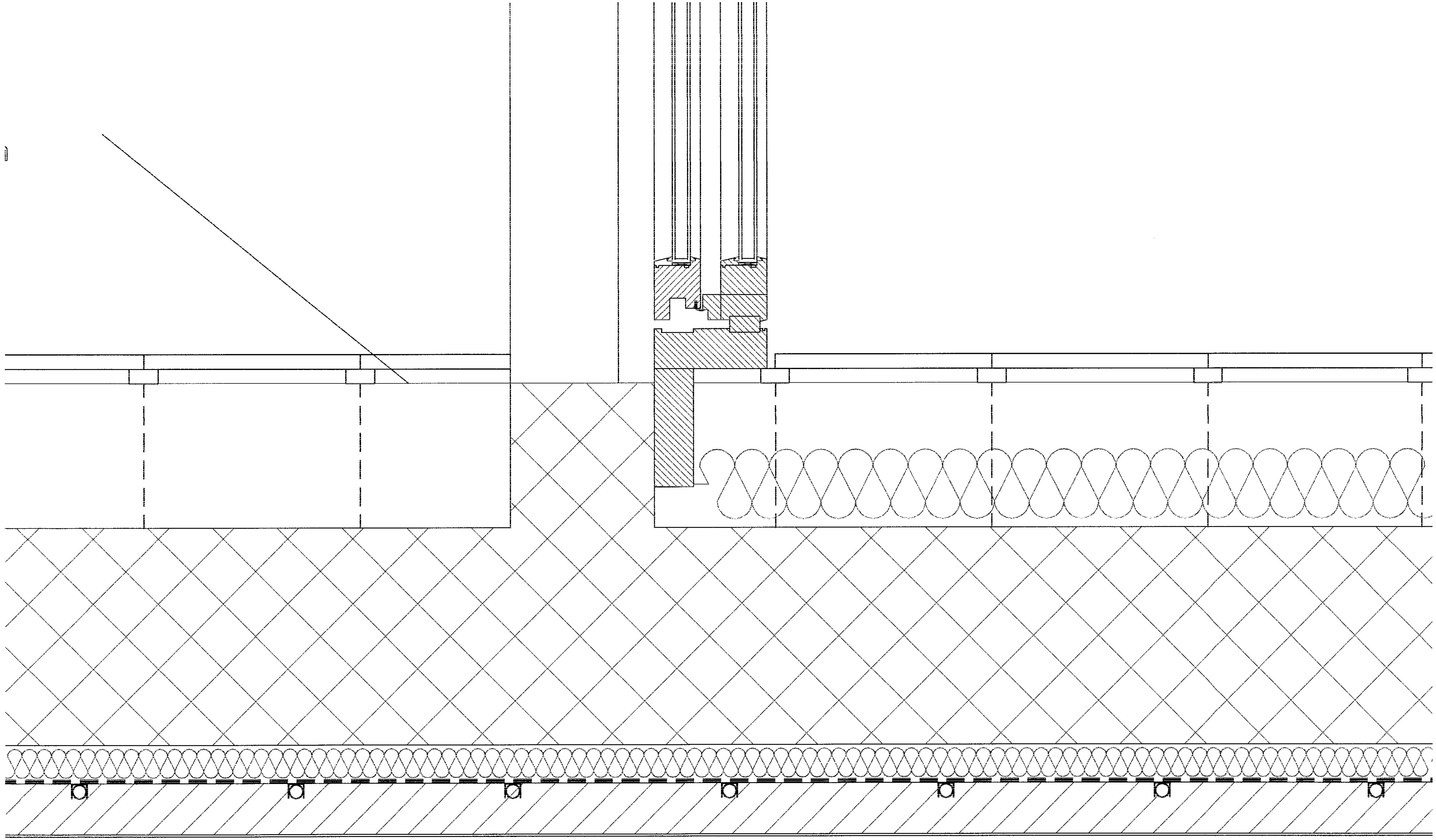


SCHIEBETÜR · MEHRZWECKRAUM 1:10



SCHIEBETÜRSCHWELLE 1:5

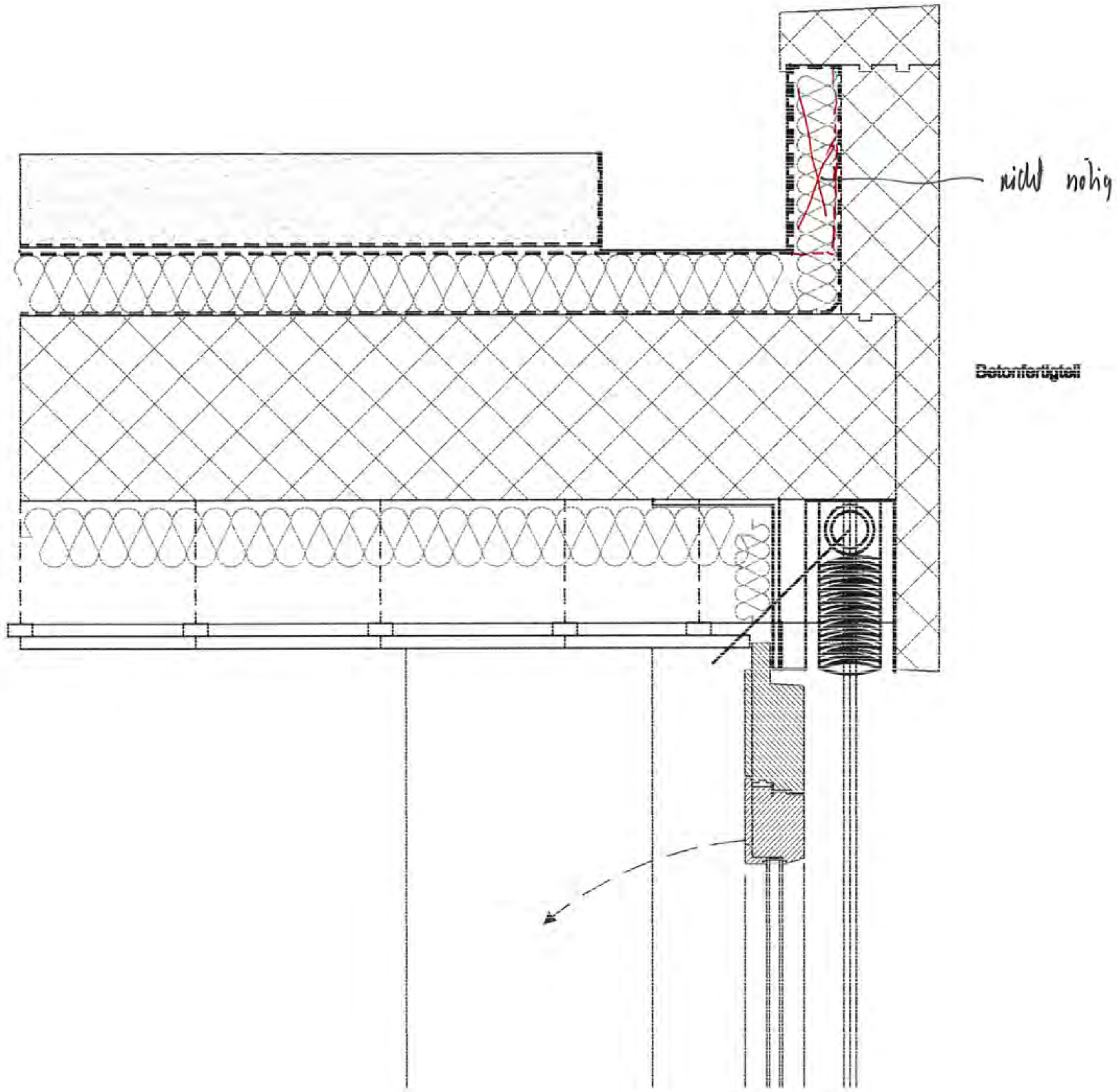




SCHIEBETÜR SCHULE 1:5

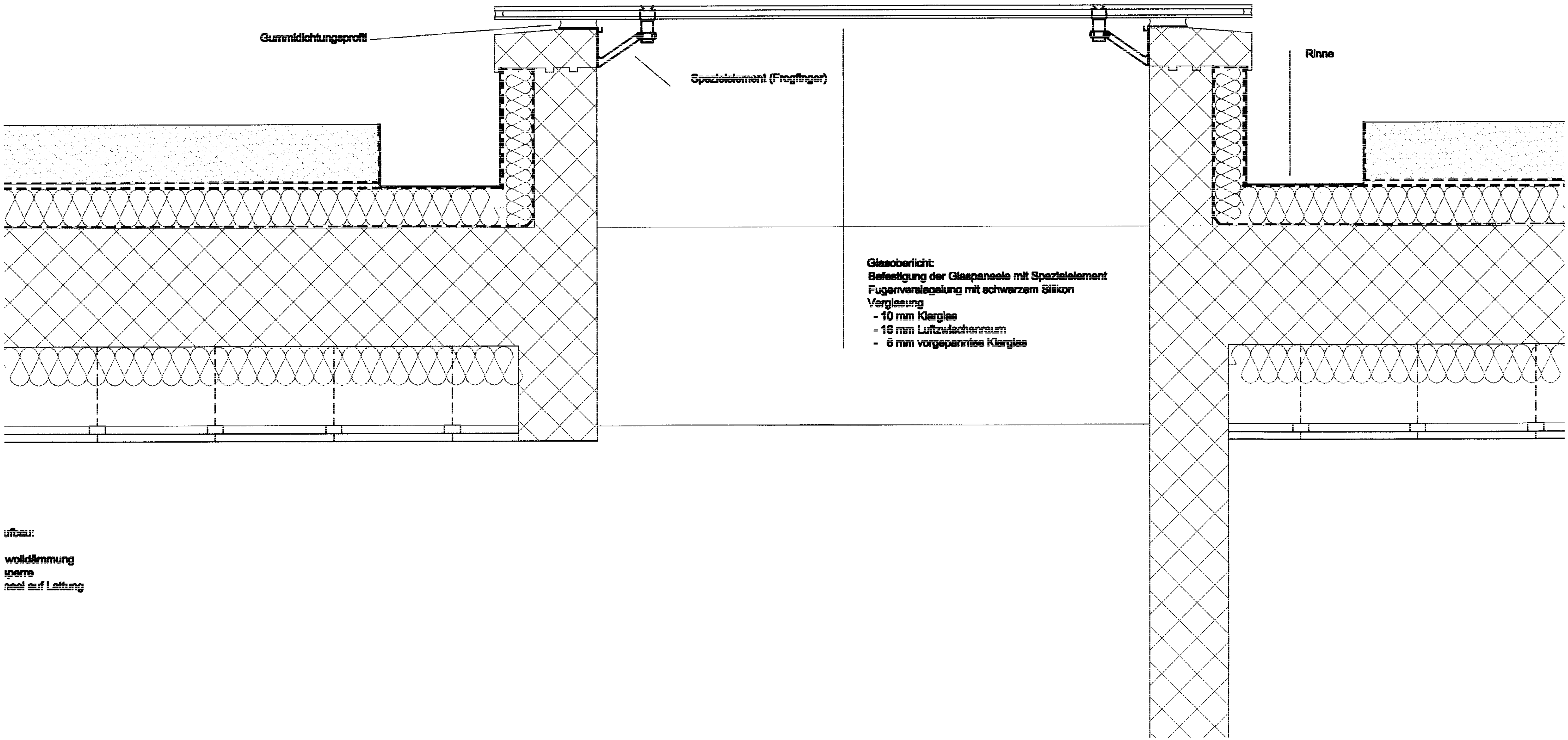
Gebäudedach:
Extensive Dachbegrünung
- Vegetationsmatte
- Substratschicht
- Filtervlies
- Drainmatte
- Filz
- glasvliesverstärkte Kunststoffabdeckung

Hartschaumplatten
Dichtungsmatte
Beton
Mineralwolldämmung
abgehängte Decke (gelochte Holzplatten)



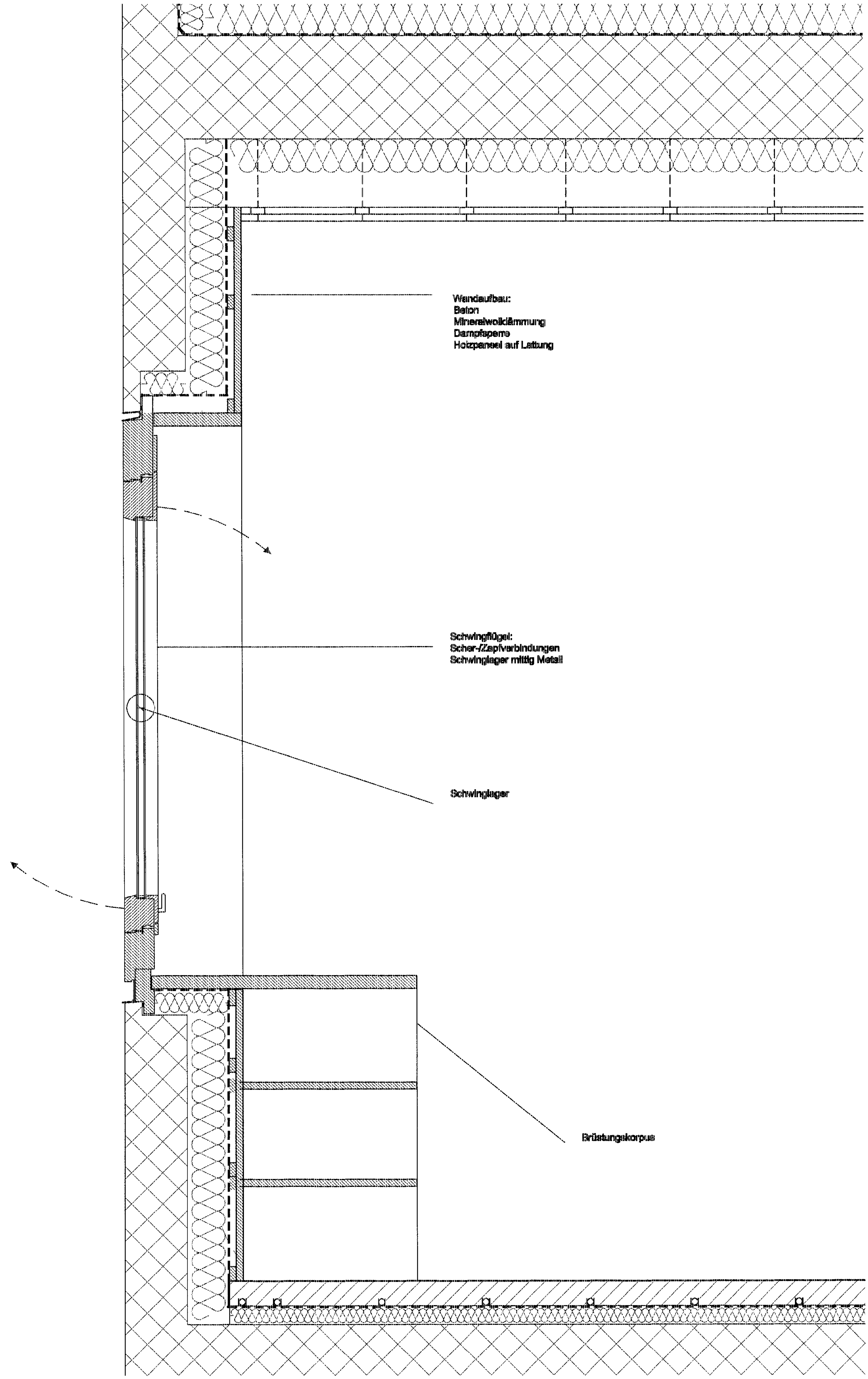
DACHABSCHLUSS SCHULE 1:10

OBLICHT SCHULDACH 1:10



ufbau:

wolldämmung
sperre
neel auf Lattung



SCHWINGFENSTER 1:10

DIE BAUELEMENTE

Band I Fenster aus Holz und Metall
von Professor Dr. e. h. Adolf G. Schneck

Band II Türen aus Holz und Metall
von Professor Dr. e. h. Adolf G. Schneck

Band III Treppen aus Stein, Holz und Metall
von Professor Franz Schuster

Band IV Balkone, Laubengänge und Terrassen
von Professor Franz Schuster

JULIUS HOFFMANN VERLAG
STUTTGART

WINDOWS

FENETRES

FENSTER

AUS HOLZ UND METALL

Konstruktion und Fensteranschlag

Ein Überblick über das Gesamtgebiet in 620 maßstäblichen Rissen und Schnitten und 324 Lichtbildern

Herausgegeben und bearbeitet von Professor Dr. e. h.

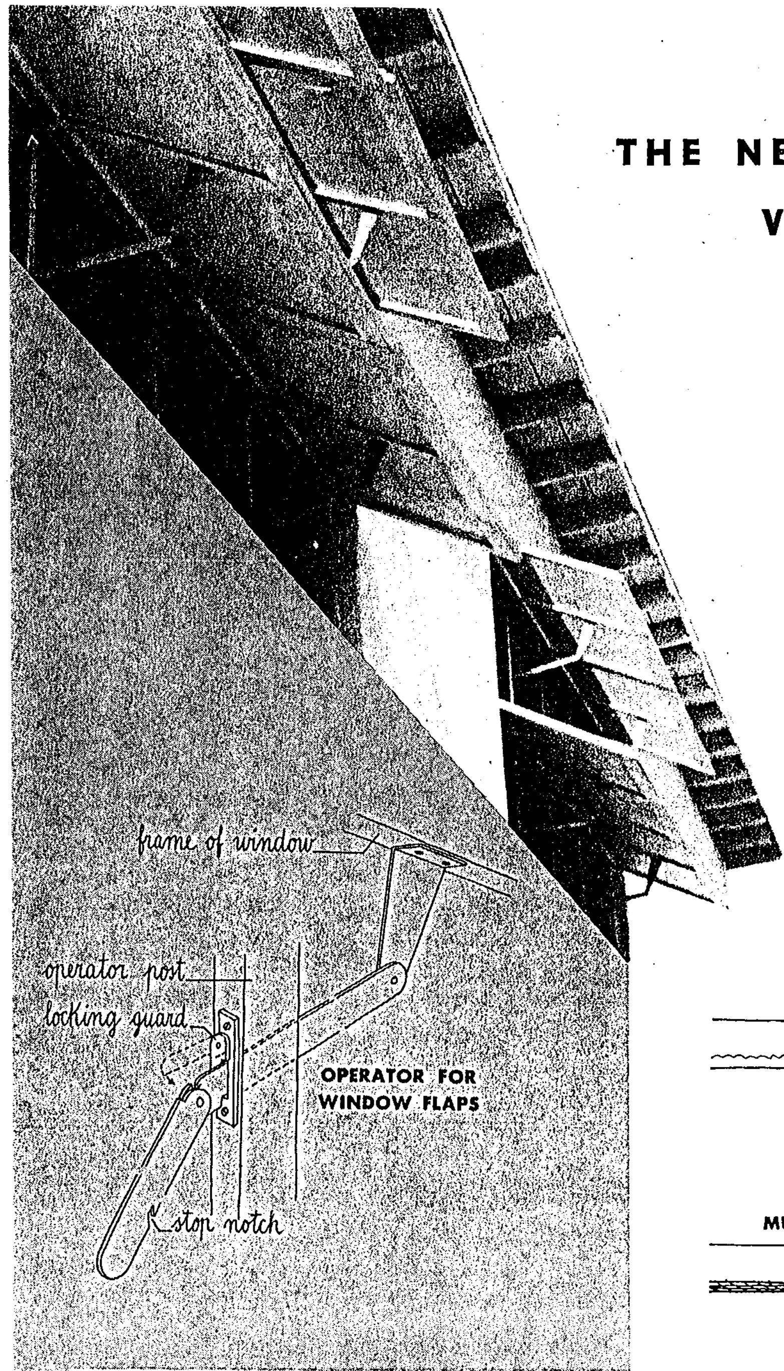
ADOLF G. SCHNECK

Mit einem Beitrag über praktische und theoretische Fragen von Dr.-Ing. Alfred Beck-Richter

Siebte, neu bearbeitete und erweiterte Auflage

JULIUS HOFFMANN VERLAG
STUTTGART

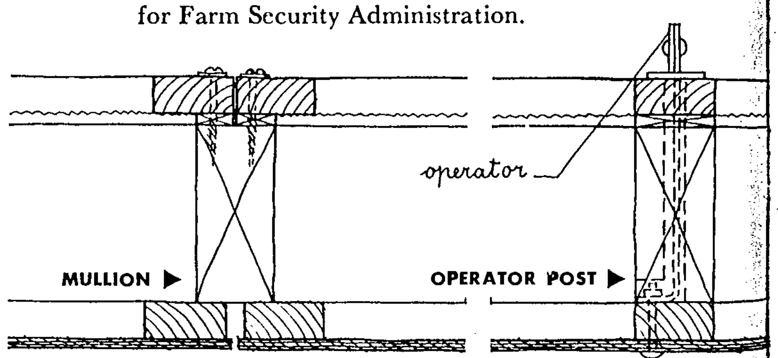
THE NEED HERE WAS LOW-COST VENTILATION, LESS LIGHT



OPERATOR FOR WINDOW FLAPS

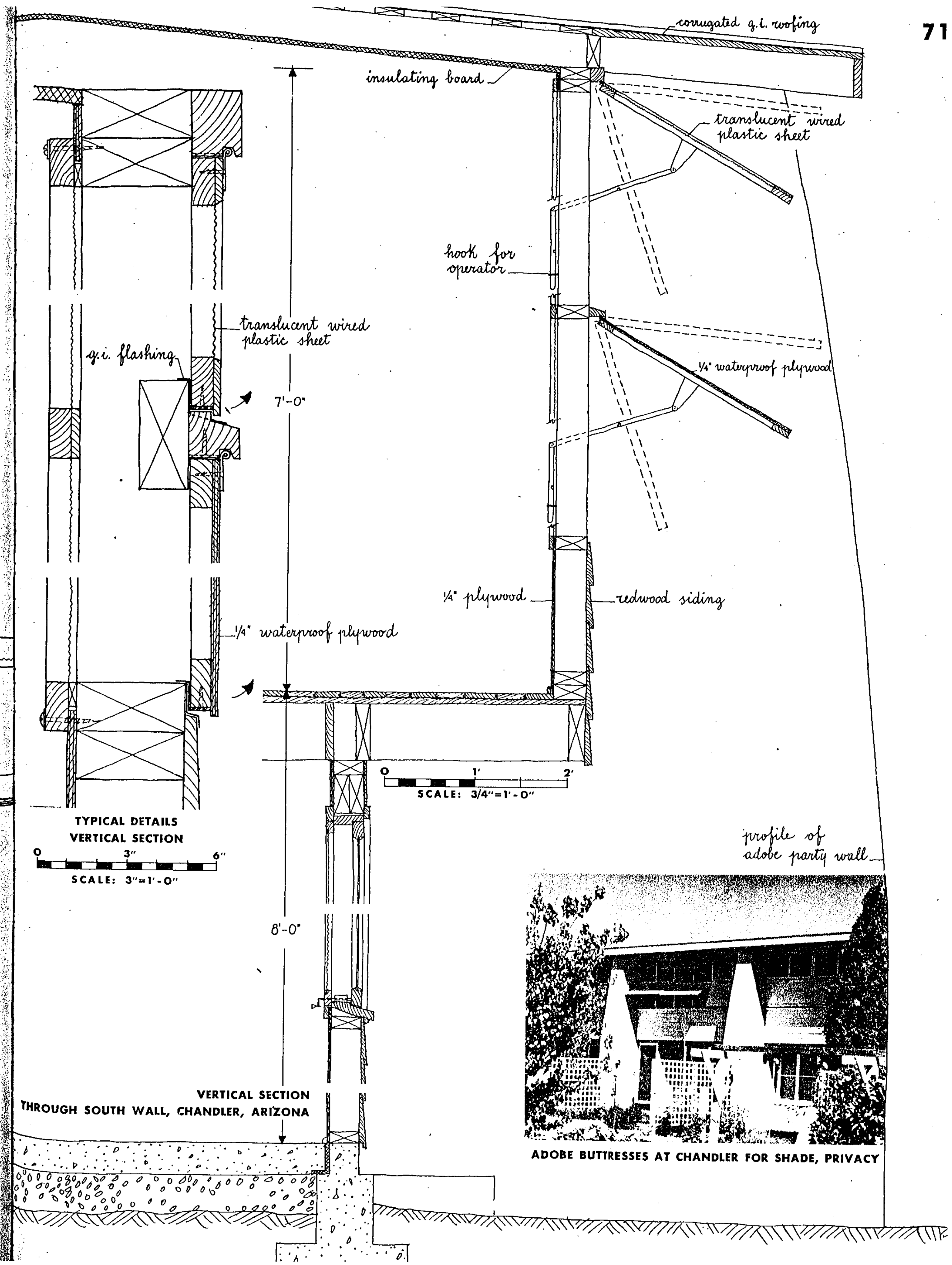
The Farm Security Administration was faced with the need for low-cost housing for migratory agricultural workers in the South-West and California. Quite a number of row-house settlements were put up, each following the same basic designs, but each succeeding one modified and improved in detail by experience, and by the opportunities of local materials such as the adobe walls at Chandler, Arizona, illustrated opposite. To make such houses livable in a blinding heat of as much as 120 in the shade, the sleeping quarters, on the second floor, have no windows in the ordinary sense of that word, just top-hinged flaps of wood frame covered with plywood and translucent plastic. In this the designers were following local tradition of canvas-covered sunflaps to shade screened porches. Canvas, however, was not considered sufficiently durable for public housing. The operator bar was also a local type of hardware, but the locking guard, which also keeps out insects which might penetrate the slot, is an F.S.A. refinement.

Architects: Vernon De Mars, Burton D. Cairns; for Farm Security Administration.



TYPICAL DETAILS: HORIZONTAL SECTION AT PLYWOOD FLAPS


UNSHADED NORTH FRONT AT VISALIA CAMP, TULARE, CALIFORNIA



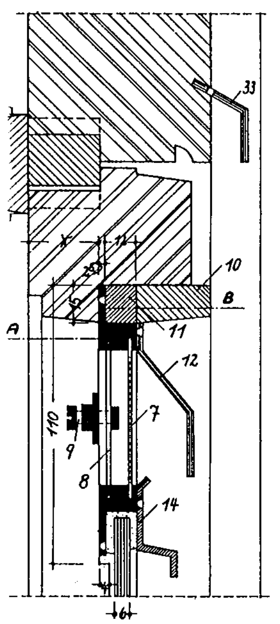
TYPICAL DETAILS VERTICAL SECTION

VERTICAL SECTION THROUGH SOUTH WALL, CHANDLER, ARIZONA

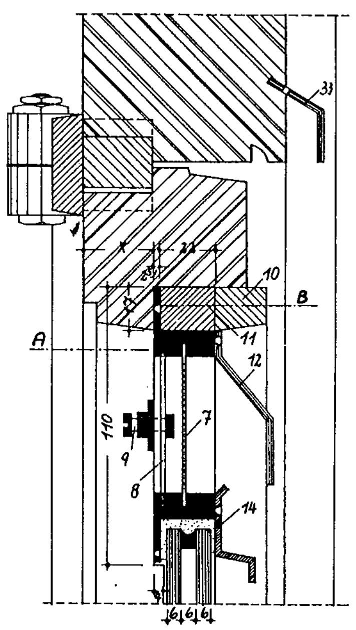
ADOBE BUTTRESSES AT CHANDLER FOR SHADE, PRIVACY

ermanent-Schieberlüftung. Die Lüftungsvorrichtung ist am Flügel angebracht

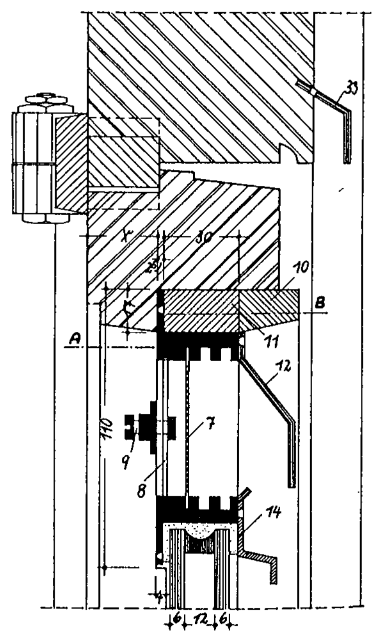
7 Ungezieferschutz
8 Lüftungsschieber aus Leichtmetall
9 Lüftungsschieber-Rosette für Hebelstangenanschluß
12 Wetterschenkel
14 Regennase
33 Wetterschenkel



ir Verglasungen mit beliebigem
ensterglas

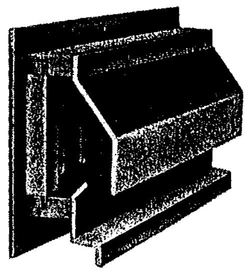


Für Isolierglas bis zu 18 mm Stärke

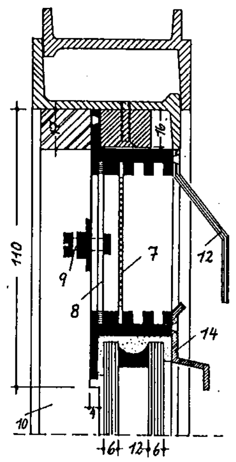


Für Isolierglas bis zu 24 mm Stärke

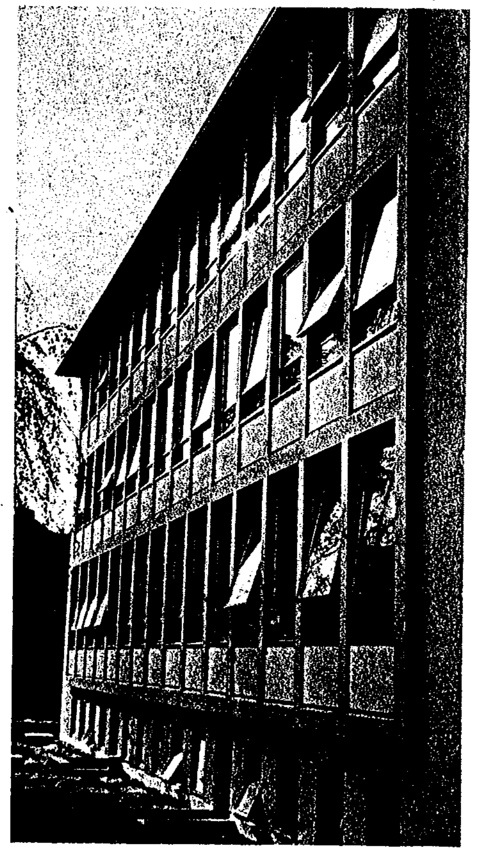
Hersteller Gretsch-Unitas GmbH, Stuttgart-Feuerbach

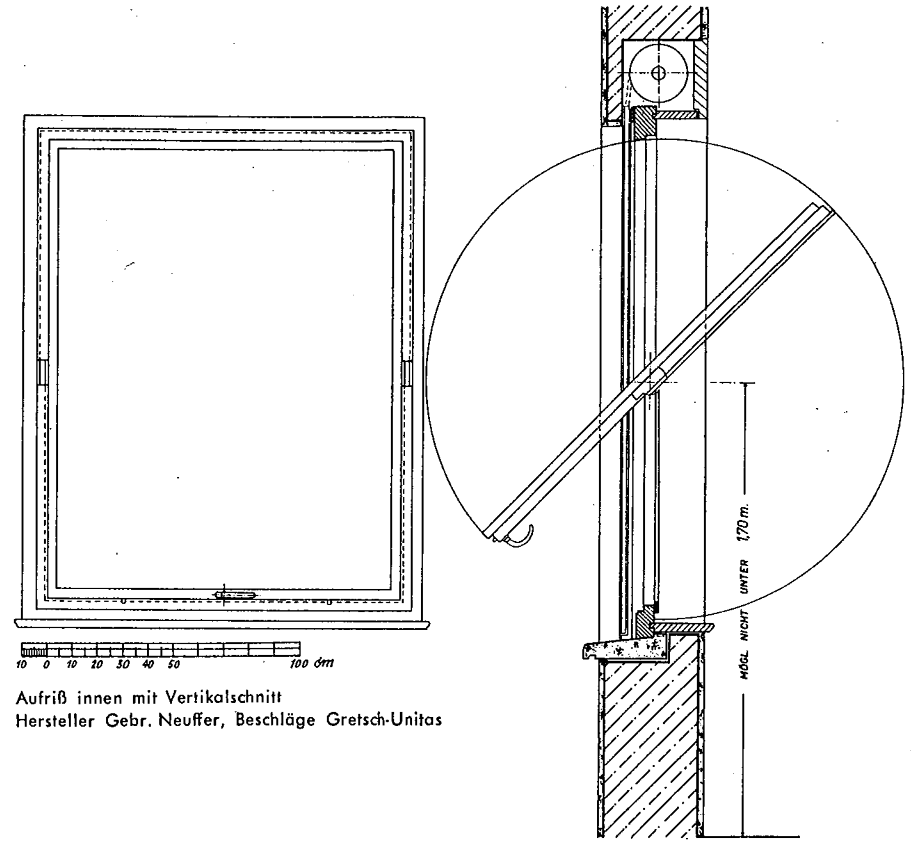


Schnitt durch die Schieberlüftung

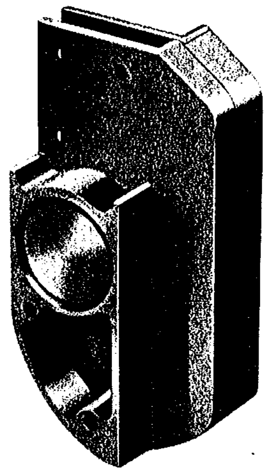


Lüftungsvorrichtung im Metallfenster

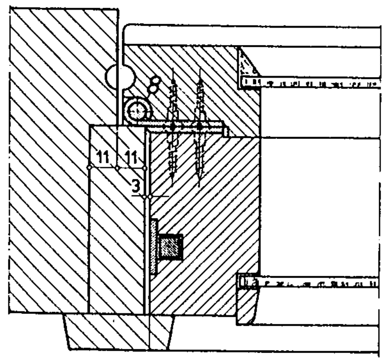




Aufriß innen mit Vertikalschnitt
Hersteller Gebr. Neuffer, Beschläge Gretsch-Unitas

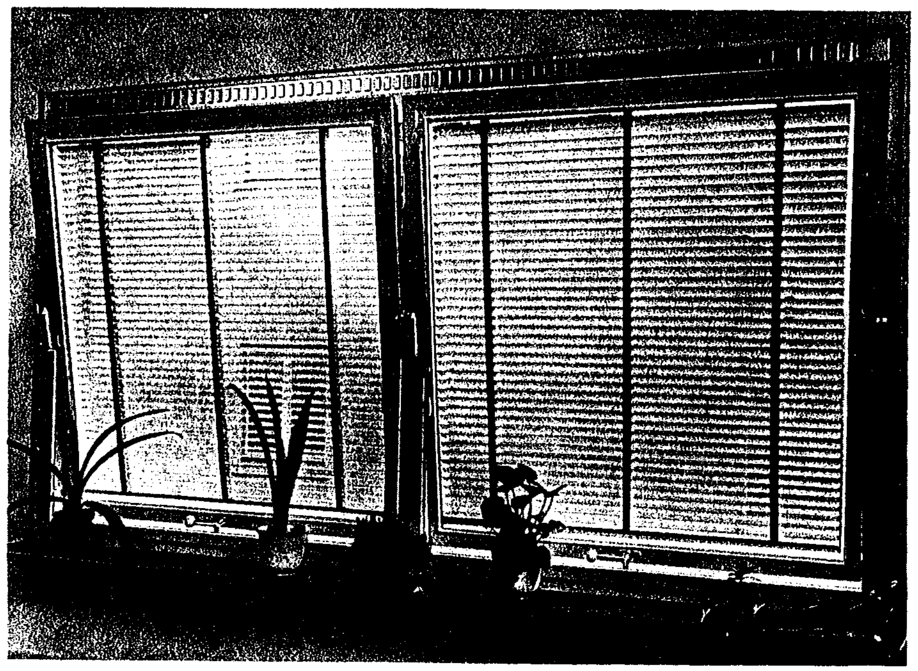


Schwinglager für große Flügel



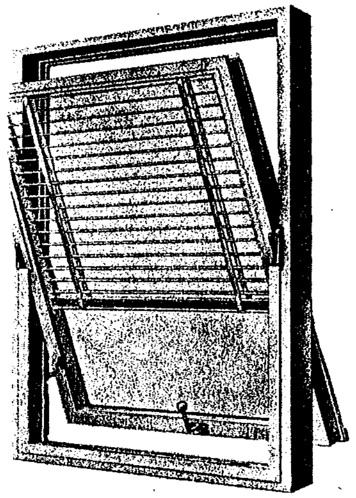
Querschnitt

Schwingflügelfenster

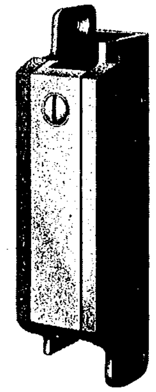


Lüftungsvorrichtung am Fensterrahmen (Gretsch-Unitas)

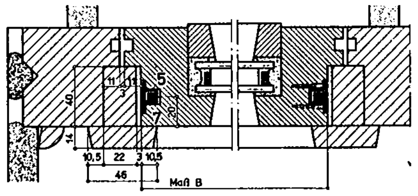
Hersteller Gretsch-Unitas GmbH, Stuttgart-Feuerbach



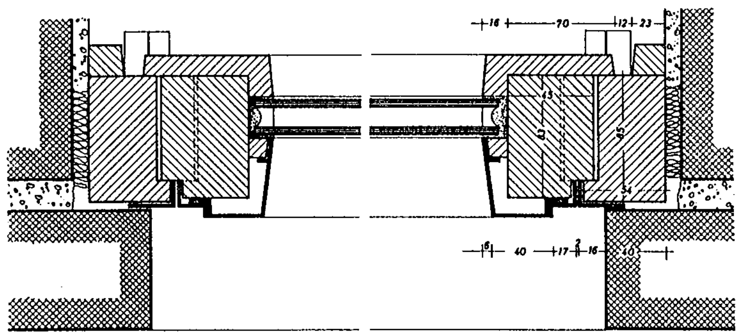
Schwingfenster als Verbundflügel mit Lamellenstore zwischen den Scheiben (Gretsch-Unitas)



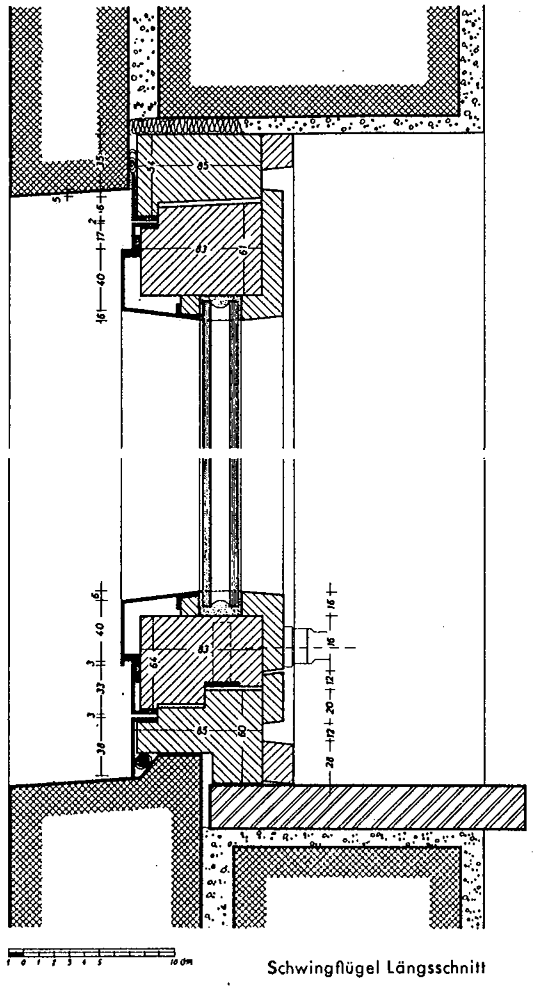
Schwinglager (Gretsch-Unitas)



Querschnitt (Gretsch-Unitas)

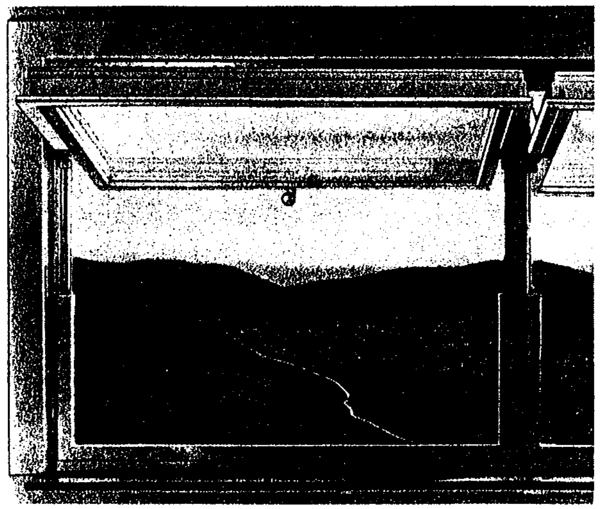


Schwingflügel Querschnitt

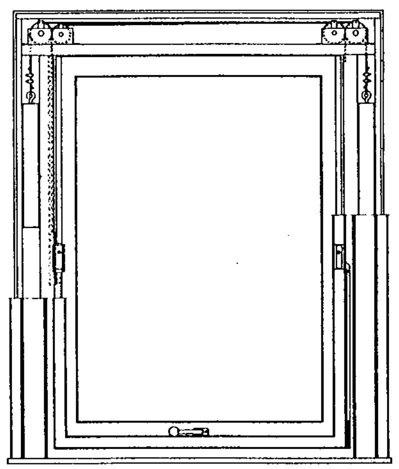


Schwingflügel Längsschnitt

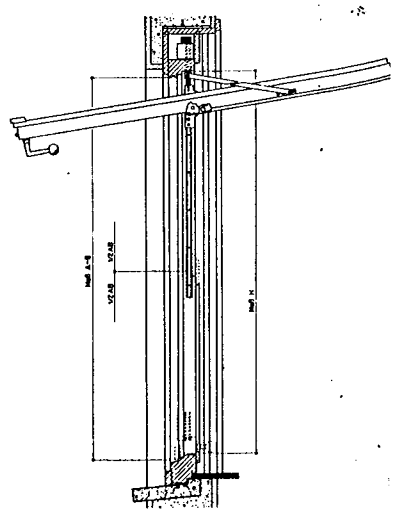
Fenster mit Leichtmetall-Verkleidung und Doppelverglasung (Gebr. Neuffer)



Schwing-Schiebefensteranlage mit 2 Flügeln (Gretsch-Unitas)



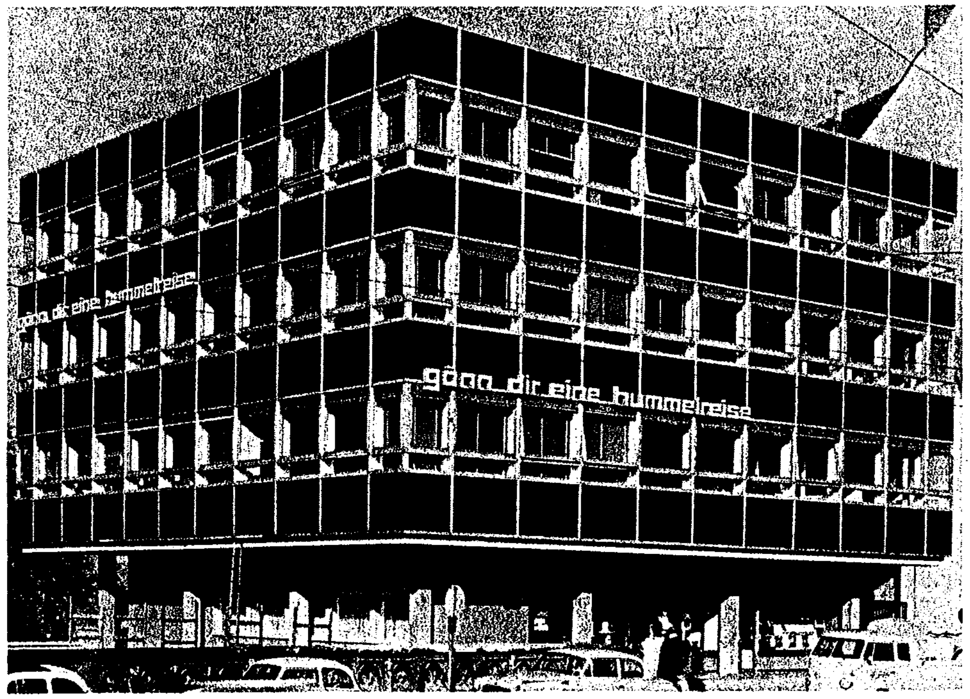
Ansicht

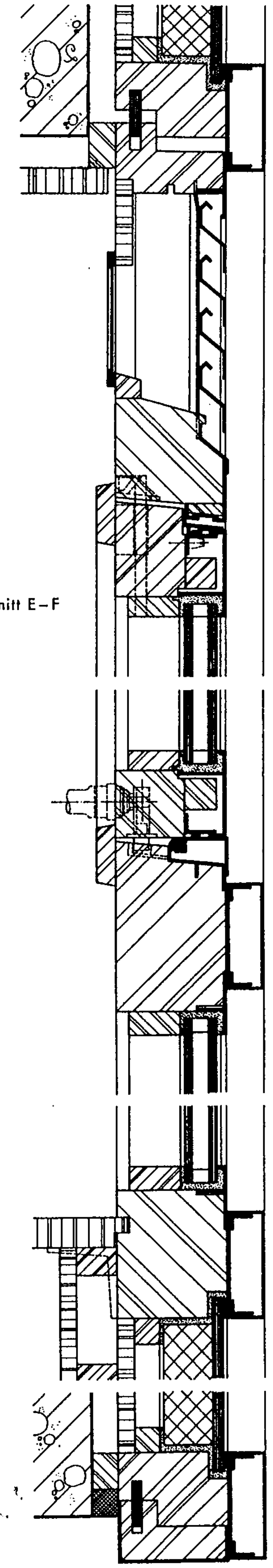


Längsschnitt

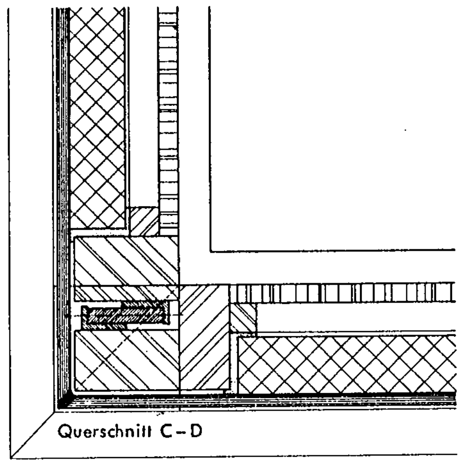
Schwingfenster (oben) und
Schwing-Schiebefenster (unten)

Hersteller Gretsch-Unitas GmbH, Stuttgart-Feuerbach
Gebr. Neuffer KG, Stuttgart

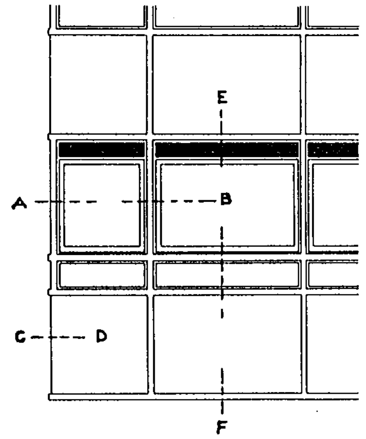




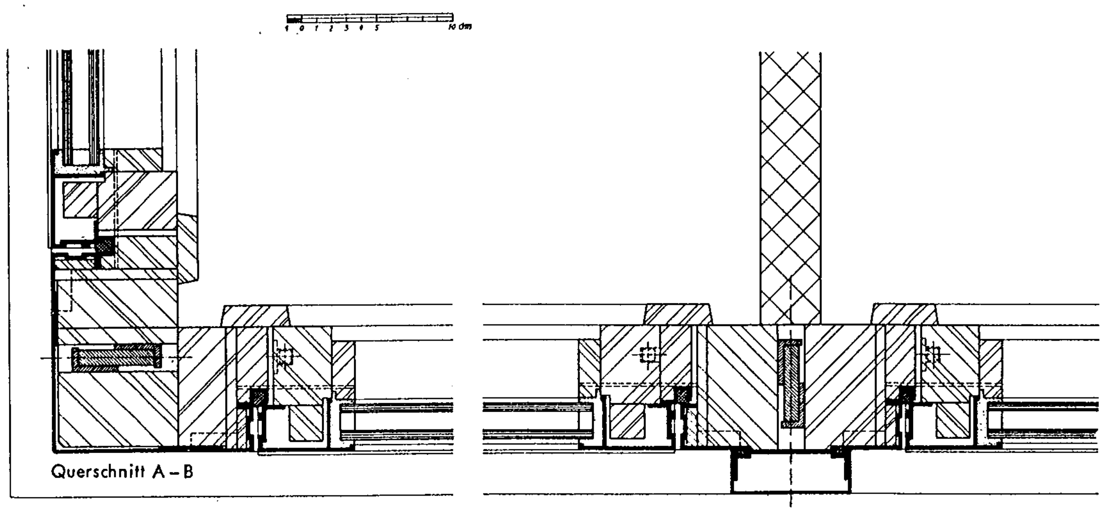
Längsschnitt E – F



Querschnitt C – D



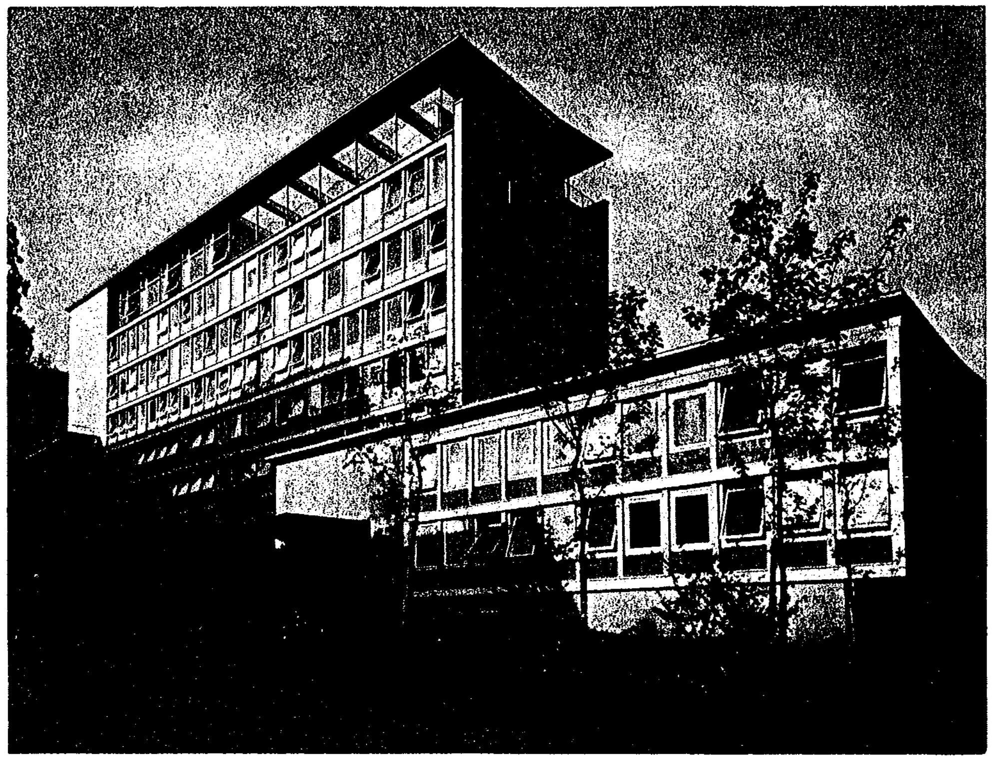
Ansicht mit Schnitten
M 1:100



Querschnitt A – B

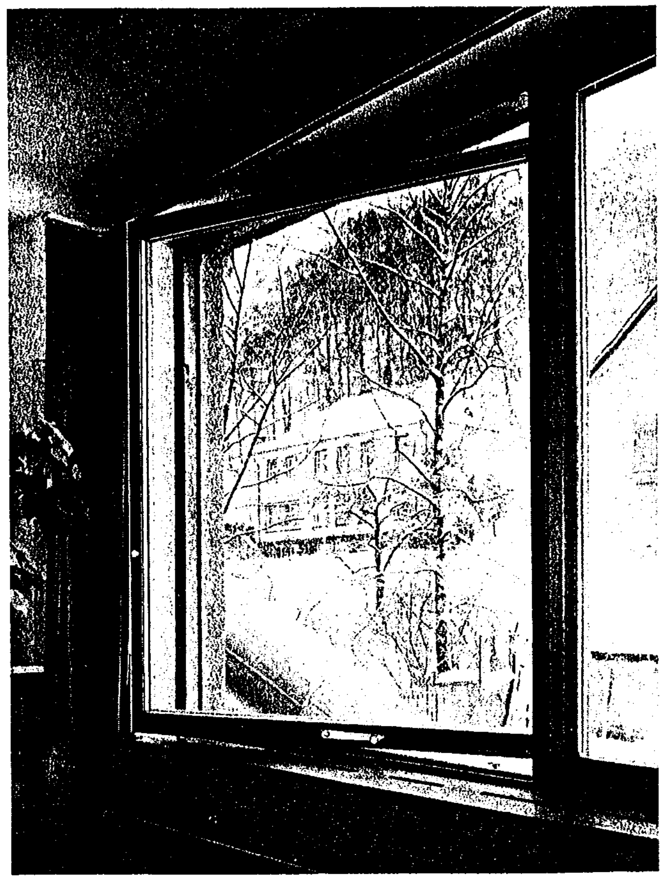
Schwingflügel mit Leichtmetall-Verkleidung. Bauart ALUH

Architekt Rolf Wékel, Hannover
Ort Reisebüro, Hannover
Hersteller Nachweis durch Alco Bauzubehörgesellschaft mbH., Goslar



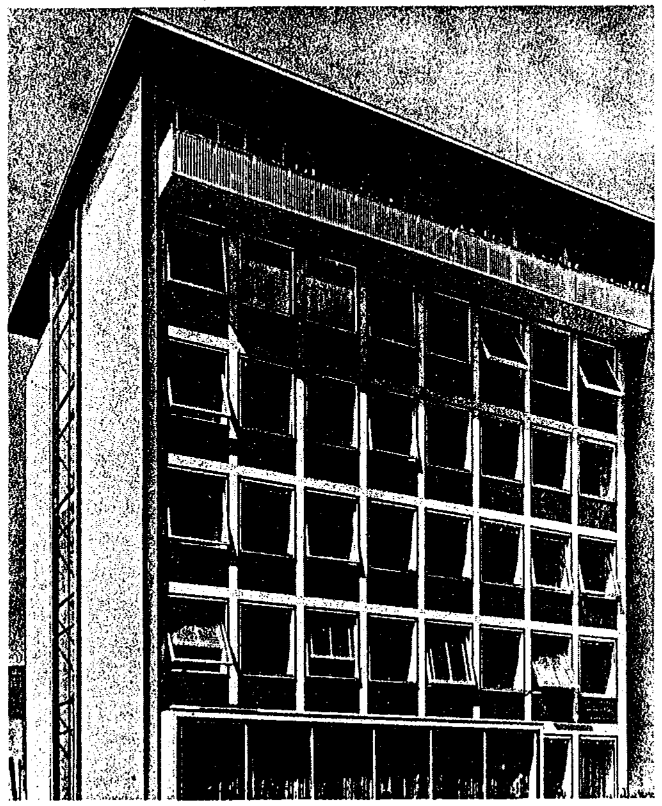
Schwäb. Treuhand AG., Stuttgart. Architekt Prof. Hans Volkart, Stuttgart

Hebe-Schwingflügelfenster D.B.Pat. Die Flügel werden durch Senken und Aufpressen fest gedichtet. Automatische Feststellung durch selbsttätig wirkende Bremslager

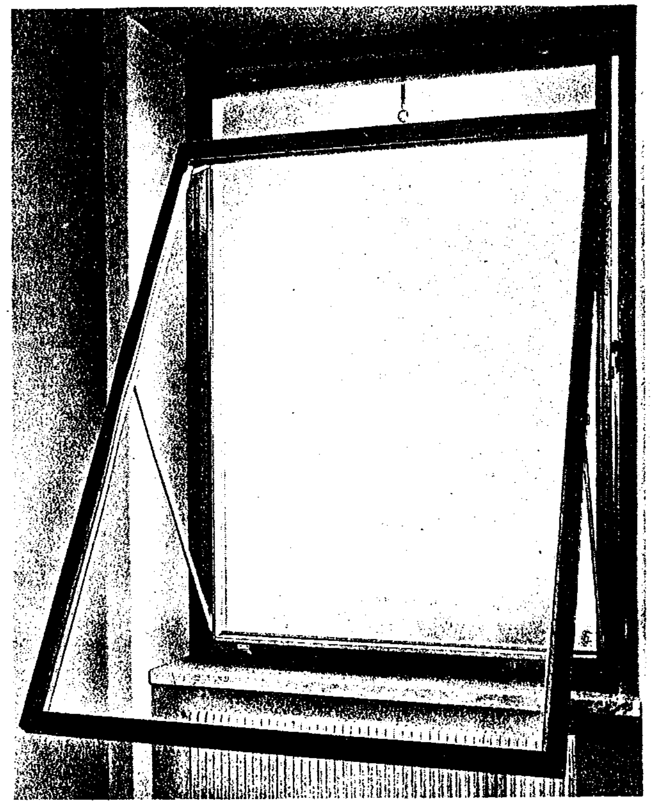


Hebe-Wendeflügelfenster D.B.Pat. Die Flügel werden ebenfalls durch Senken und Aufpressen dicht geschlossen.
Hersteller beider Fenster Johannes Schmid, Blaubeuren

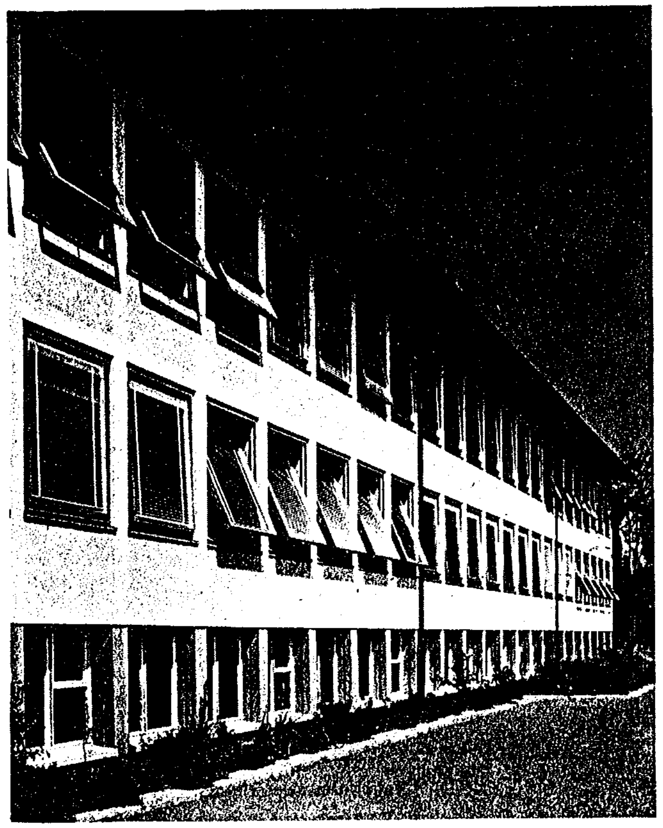
Die Schwing- und Wendeflügelfenster können sowohl als einfache wie auch als Verbundfenster hergestellt werden



Gebäude der Treuhand Gesellschaft Frankfurt/M., System Carda



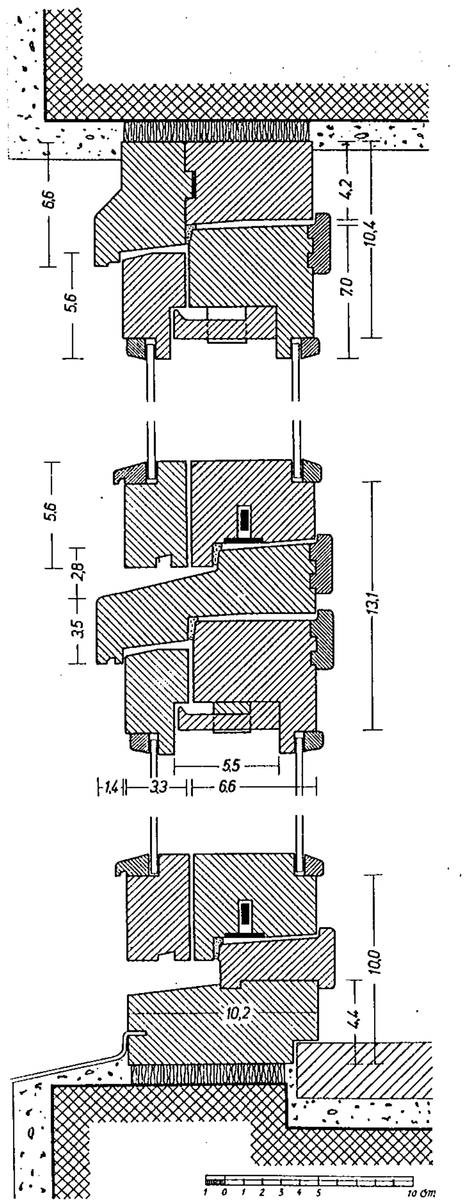
Die beiden Flügel des Schwingflügelfensters können zum Reinigen auseinander genommen werden. Hersteller A. B. Atvidaberg, Stockholm. System Carda



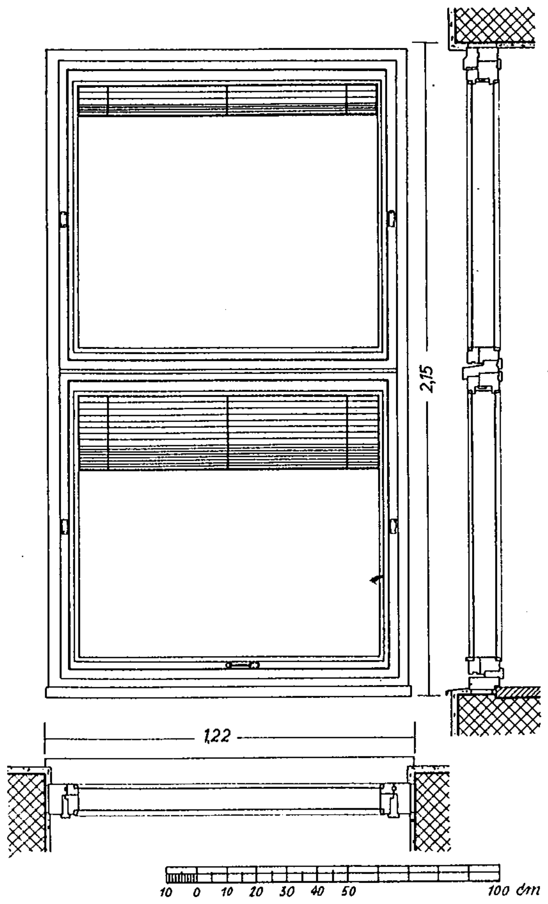
Einflügelige Carda-Fenster. Schulhaus Wetzikon (Schweiz). Hersteller Ernst Göhner AG., Zürich. Architekt P. Hirzel, Wetzikon

Carda-Fenster mit fest verglastem Unterteil. Hersteller Ernst Göhner AG, Zürich. Architekt Dr.-Ing. W. Dunkel, Zürich

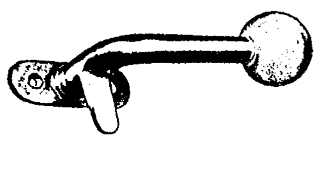
Verschiedene Arten von Schwingflügeln



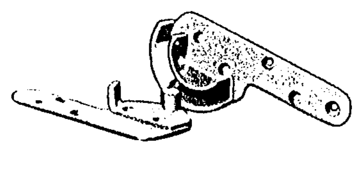
Längsschnitt



Aufriß mit dem dazwischenliegenden Lamellenstore, dazu Schnitte

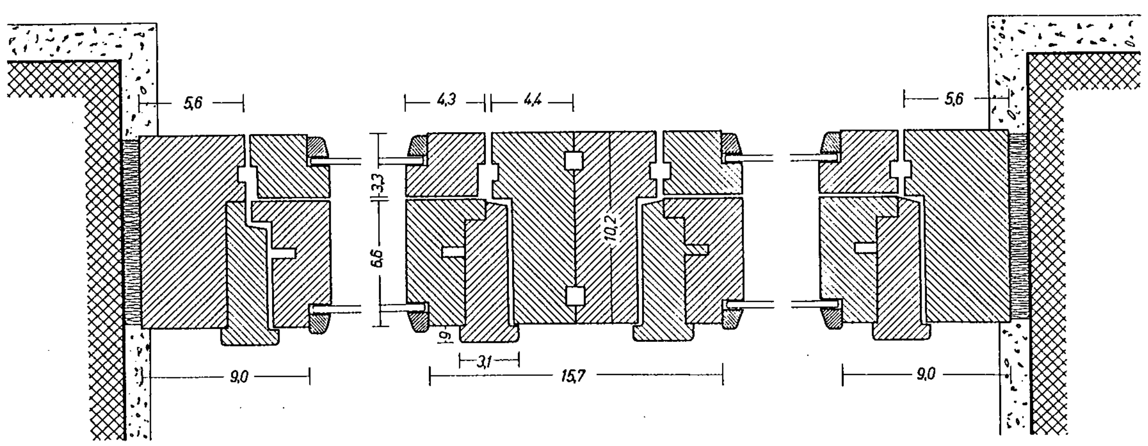


Verschlußgriff



Schwingflügellager

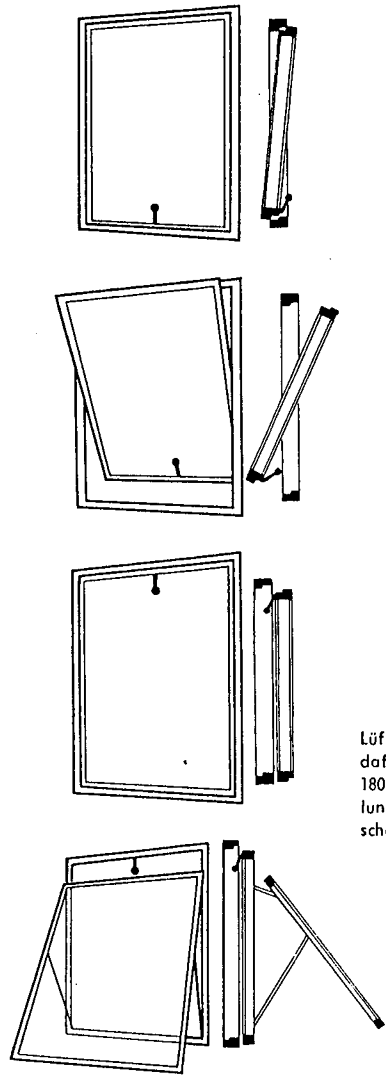
Cardafenster werden mit einem Handgriff geöffnet bzw. geschlossen. Die Fenster werden durch Friktionsbremsen automatisch in jeder gewünschten Lage gehalten



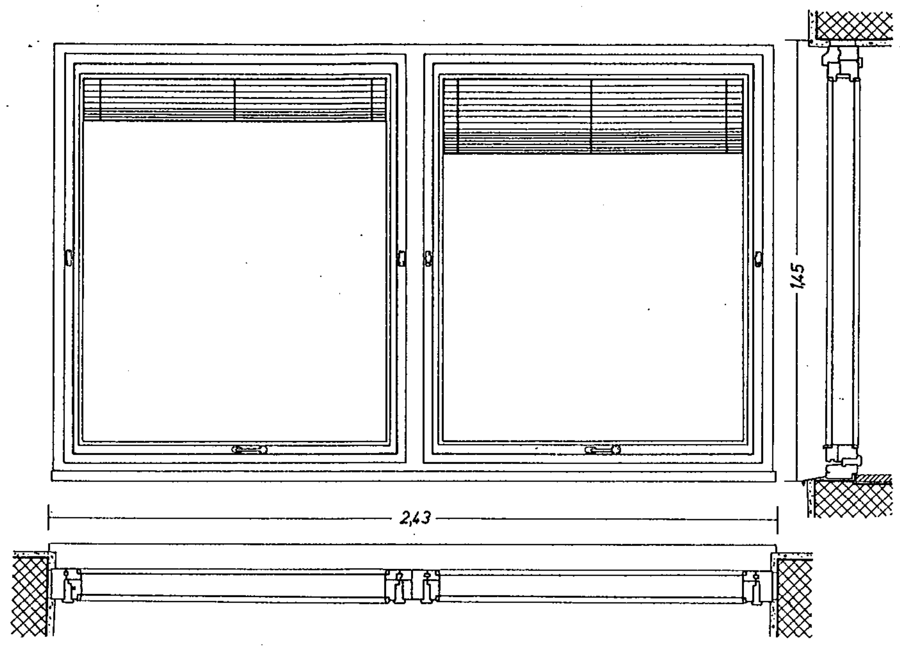
Querschnitt

Schwedisches Schwingflügelfenster
Zweiflügeliges Fenster mit übereinanderliegenden Flügeln

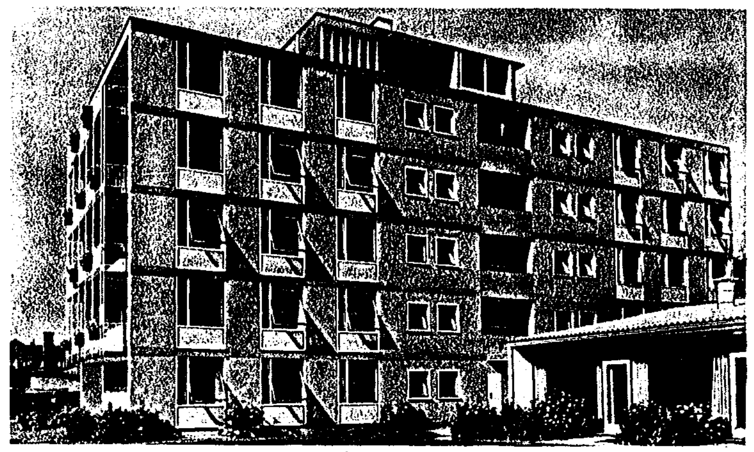
Hersteller A. B. Atvidaberg, Stockholm
System Carda



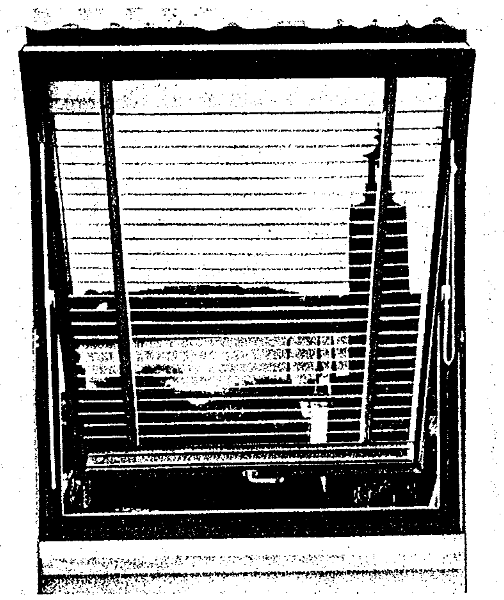
Lüftungseinstellung des Cardafensters, Drehung bis zu 180° möglich. In dieser Stellung kann man die Fensterscheiben leicht reinigen



Aufriß innen mit Schnitten eines zweiflügeligen Fensters mit nebeneinanderliegenden Flügeln



Mädchenheim in München mit Carda-Fenster

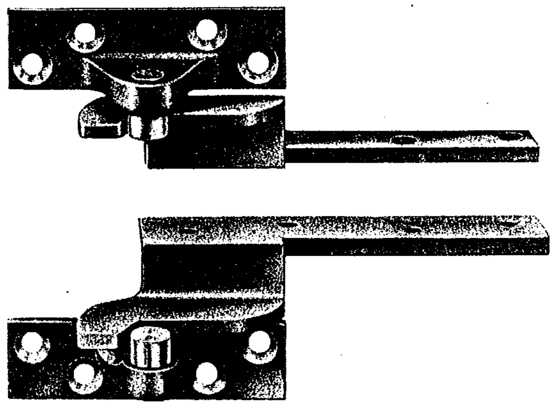


Geöffnetes Carda-Fenster mit eingebautem Lamellenstore, dessen einzelne Plättchen durch eine besondere Vorrichtung geöffnet und geschlossen werden können

Büro der A. B. Scania-Vabis, Södertalje (Schweden)

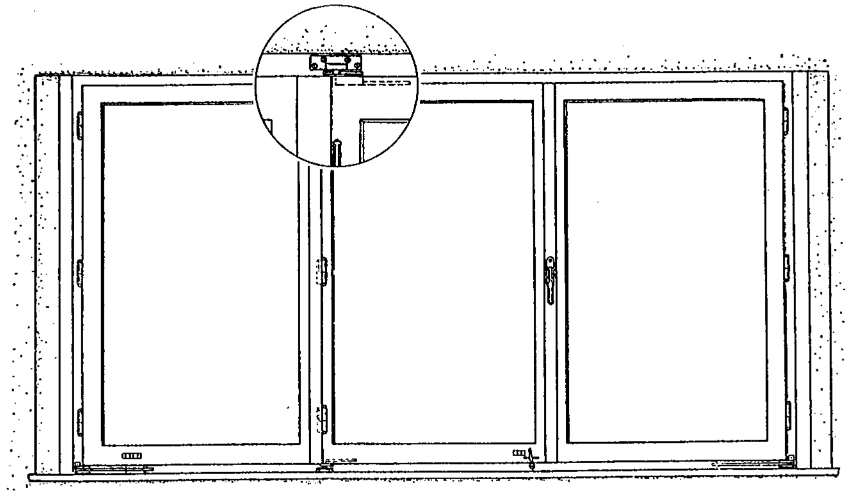
Schwedisches Schwingflügelfenster

Hersteller A. B. Atvidaberg, Stockholm
System Carda

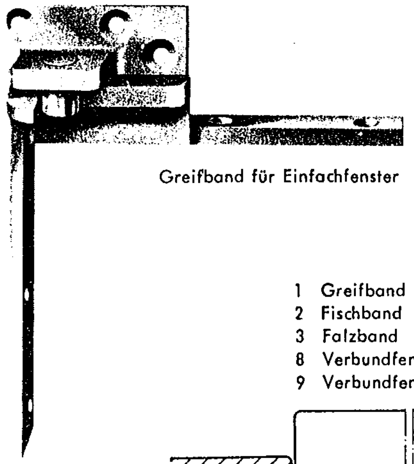


Greifbänder für Verbundfenster

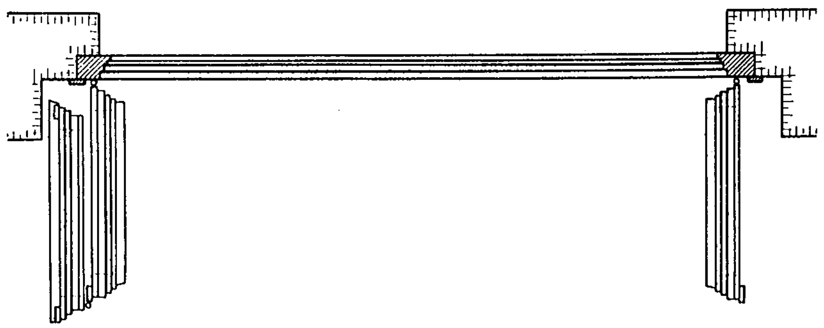
Die Greifbänder führen den Mittelflügel bis zu einem Öffnungswinkel von 150°



Dreiflügelfenster ohne Setzholz. Innenansicht des geschlossenen Fensters

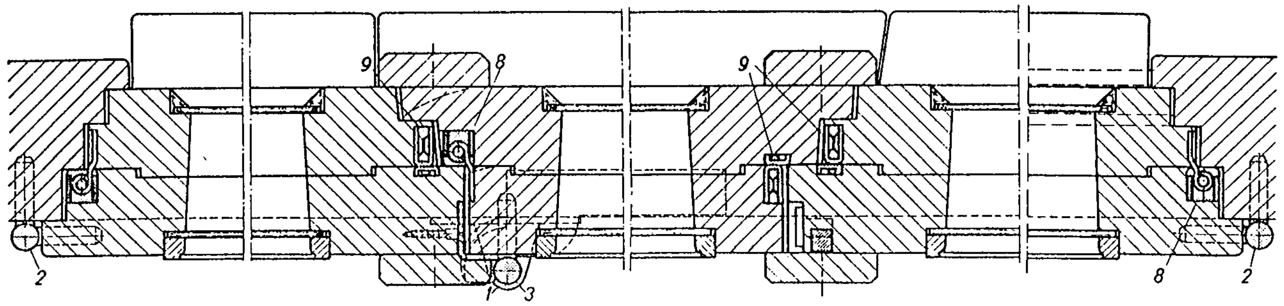


Greifband für Einfachfenster

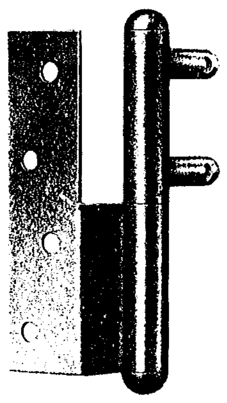


Draufsicht des geöffneten Dreiflügelfensters

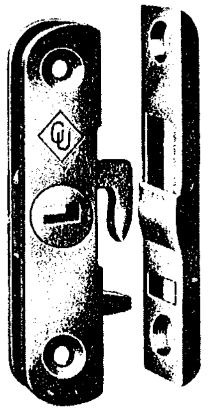
1 Greifband
2 Fischband
3 Falzband
8 Verbundfenster-Band
9 Verbundfenster-Kupplung



Querschnitt. Die Stärke des Überschlags ist mit 16 mm einzuhalten

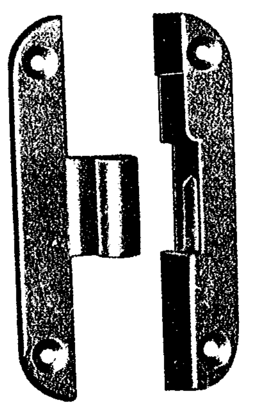


Falzband zur Verbindung von Außen- und Mittelflügel

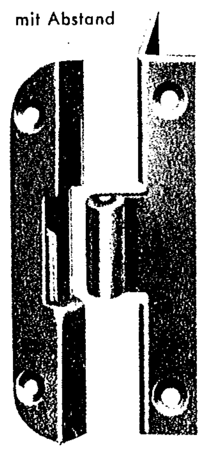


Kupplung für Verbundfenster

Bänder für Verbundfenster



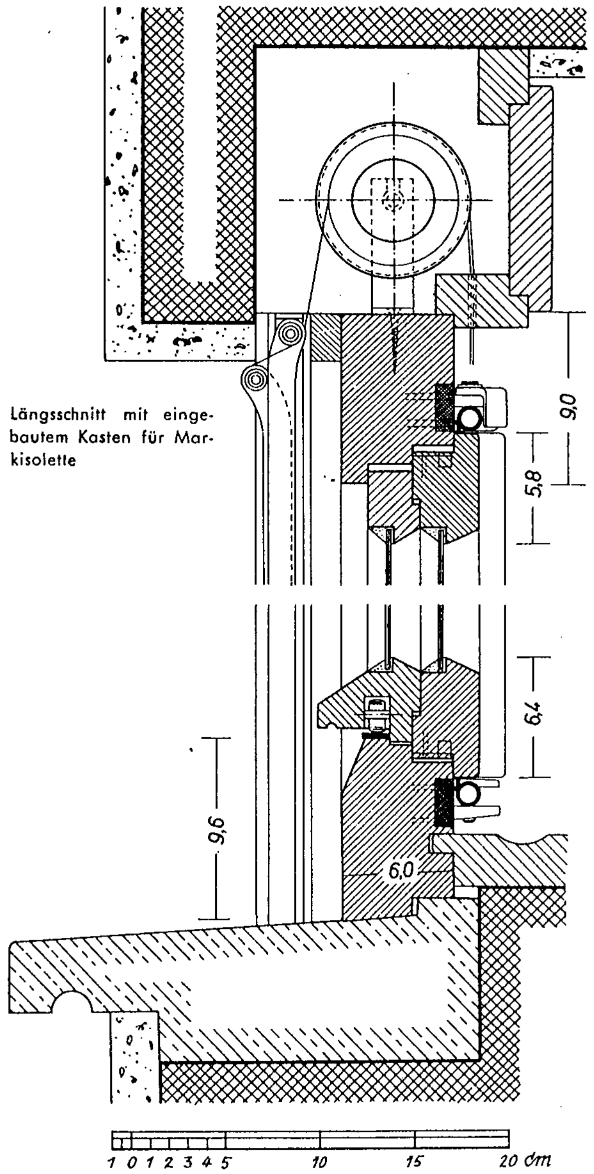
ohne Abstand



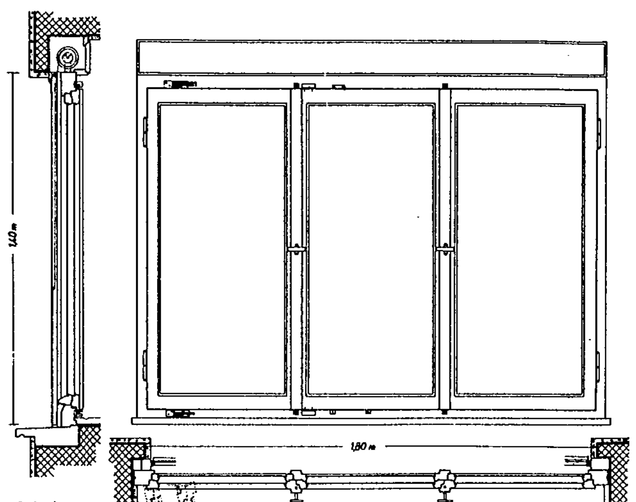
mit Abstand

Dreiflügelige Fenster ohne Setzholz
Der mittlere Flügel ist an einem der seitlichen angeschlagen

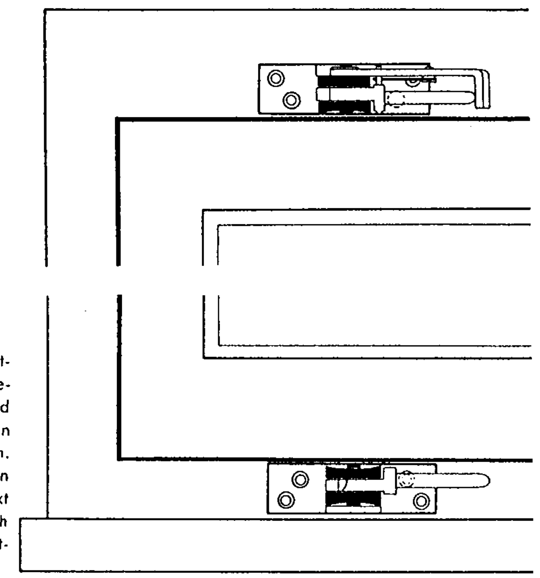
Hersteller Gretsch-Unitas GmbH, Stuttgart-Feuerbach



Längsschnitt mit eingebautem Kasten für Markisolette

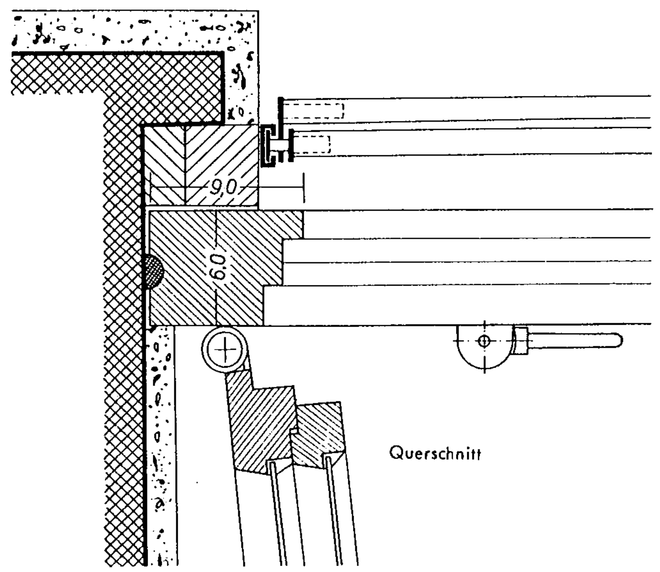


Aufriß innen mit Schnitten

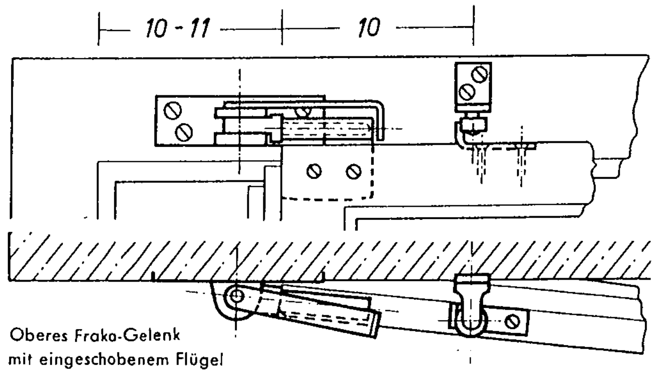


Oberes Fraka-Gelenk

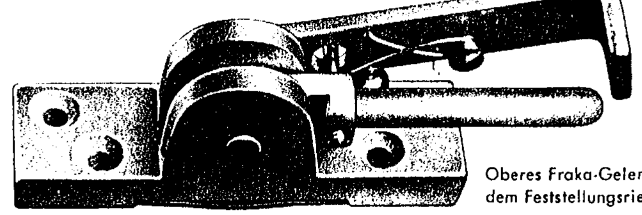
Unteres Fraka-Gelenk. Die seitlichen Flügel werden zuerst geöffnet, der mittlere Flügel wird dann nach links bzw. rechts in das Fraka-Gelenk geschoben. Zum Aufdrehen muß er gut in das obere Gelenk gedrückt werden. Er erhält dann durch die Führungsplättchen die notwendige Führung.



Querschnitt



Oberes Fraka-Gelenk mit eingeschobenem Flügel



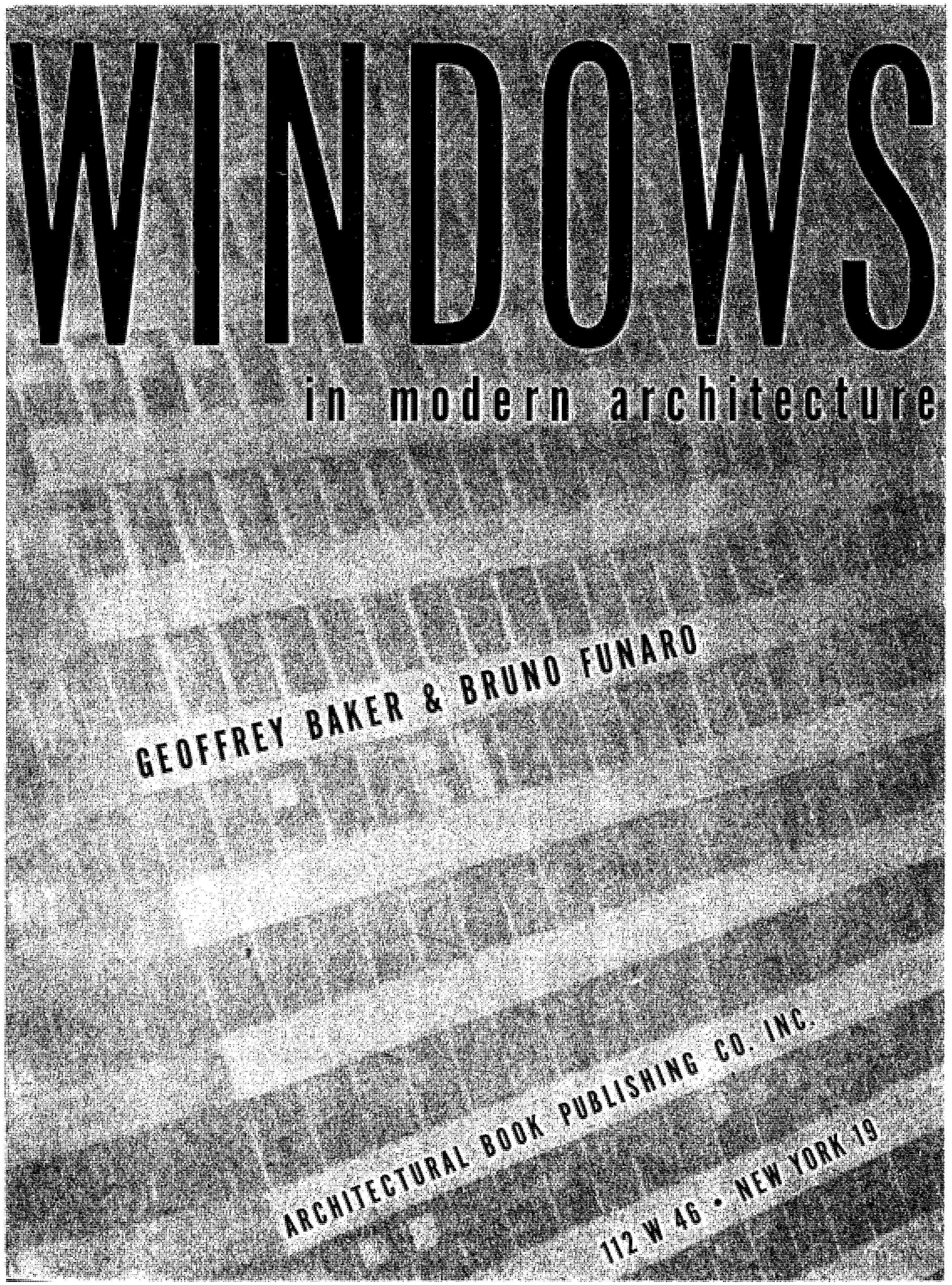
Oberes Fraka-Gelenk mit dem Feststellungsriegel

Die Flügel dieses dreiteiligen Fensters können durch eine besondere Mechanik auf die Seite geschoben werden. Ein Setzholz ist deshalb in der Mitte nicht notwendig

Hersteller Aichelmann & Kimmig, Rottweil (N.)
System »Fraka«

WINDOWS

in modern architecture



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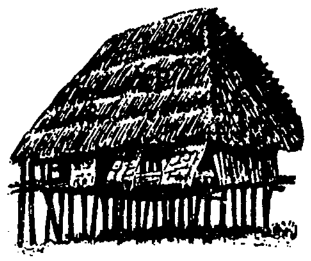
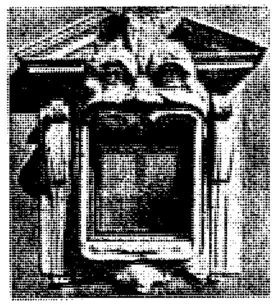
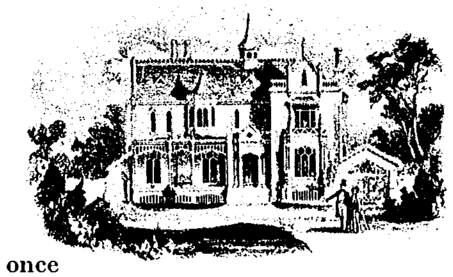
WHY IS A WINDOW?







"... at once
picturesque, unusual, and sincere."

Windows are of all sorts

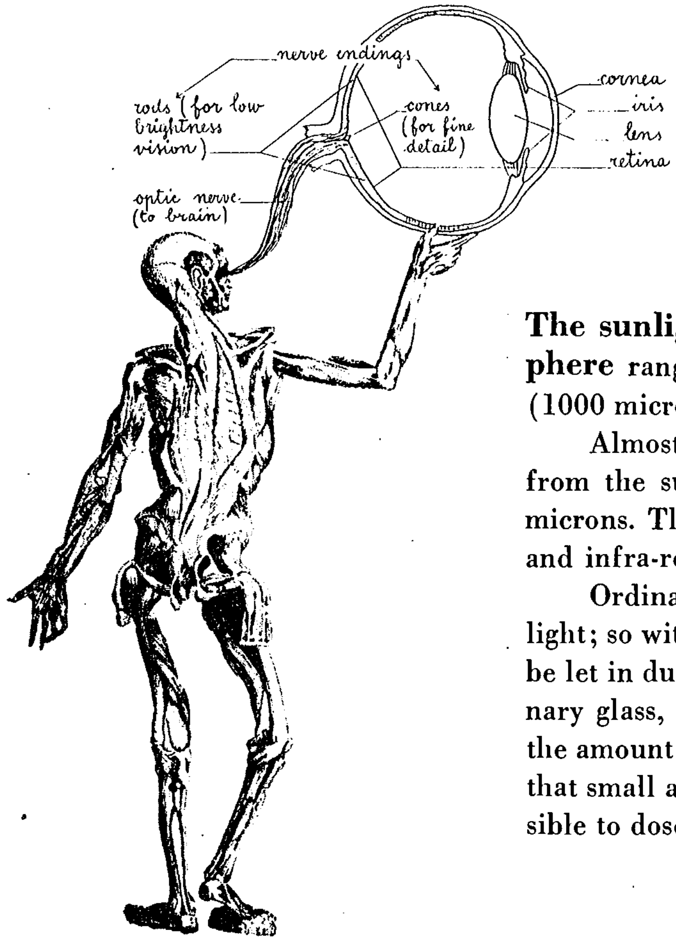
small and large, wide and tall, regularly and irregularly spaced, in the walls, in the roof, and even in the floor.

They may be left as openings, or closed with some translucent or transparent material to keep out weather and hinder the passage of heat.

But all of them, without exception, have as their main purpose:

TO LET IN DAYLIGHT. But what is daylight? It is a sensation conveyed by nerve fibers from the eye to the brain. It is a subjective sensation; it cannot be measured.

What we can measure is the intensity (brightness) and the wave length (color) of the energy which reaches the eye. The eye judges these mainly by comparison.

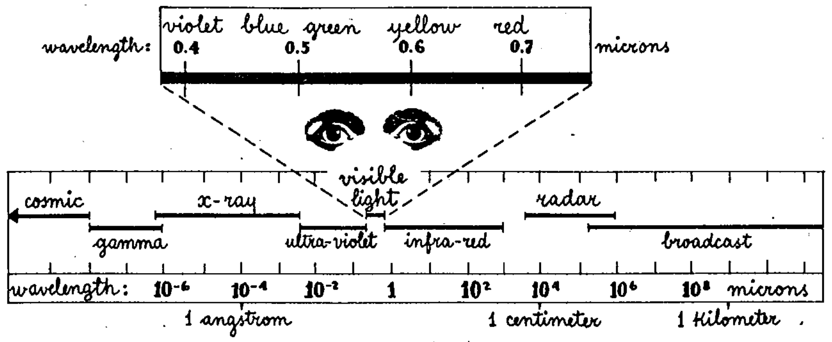


THE HUMAN EYE collects light rays and brings them to focus on the thousands of sensitive nerve ends beneath the retina. This stimulus is translated by the brain into sensations of light, shade, color. In low light the eye becomes more sensitive by developing "visual purple". In bright light the iris contracts and "visual purple" slowly turns yellow. This adaptation cannot be made suddenly.

The sunlight which penetrates the earth's atmosphere ranges in wave length from 0.29 to 2.5 microns. (1000 microns = 1 millimeter)

Almost one half the total radiation which we receive from the sun is in the form of visible light, 0.4 to 0.8 microns. The rest is ultra-violet (shorter in wave length) and infra-red (longer in wave length).

Ordinary glass will let through infra-red just as it does light; so with skillfully placed controls these heat rays can be let in during winter and kept out during summer. Ordinary glass, however, will not let through ultra-violet; but the amount of this necessary for health is so small (though that small amount is essential), that it is usually more sensible to dose with direct sunlight.



The source of daylight—THE SUN is out of man's control.

It is a point source of light, like a very powerful incandescent lamp, with a brightness* of 450,000,000 foot-lamberts. Man can neither move it nor switch it on and off.

The sun never stands still (more exactly, of course, the earth never stands still). Its movement is, however, regular, predictable; but **the intensity of daylight reaching the earth is neither regular nor predictable.**

It is dependent upon the whims of the clouds. On a dull, overcast day with misty rain, the sky will have a brightness of only 400 foot-lamberts. On a clear day with blue sky, brightness will range from 1000 to 2300 ft-L, depending upon the amount of haze.

The greatest sky-brightness will be on a lightly overcast day. Then it will run up to as much as 5000 ft-L, due to the diffusing power of light clouds (more heavily water-laden clouds appear dark). Under these conditions the sun acts as an extended light source, like a fluorescent lamp.

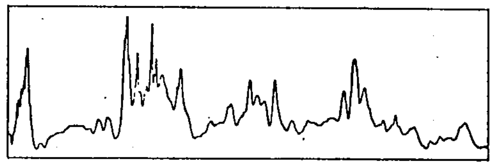
Brighter still, of course, will be objects with high reflection factors exposed to direct sunlight. A white building in direct sunlight, for example, will have a brightness of 8,000 ft-L, which is brighter than even the brightest sky. The important item here is the reflection factor. Trees in direct sunlight register only 320 ft-L.

Except at its source, the sun, **daylight is not visible until it strikes an object.** "Shafts of sunlight" are made visible only by the dust particles within them.

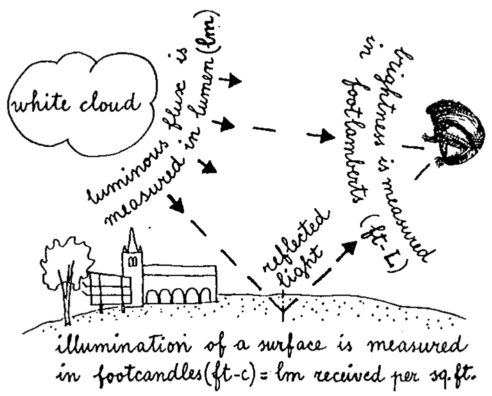
Daylight includes waves of many different wavelengths. Every time it hits an object some portion of these wave lengths are subtracted (usually absorbed by the object which they strike and converted into heat, or in some

THE EYE IS SENSITIVE to only a single "octave" of the waves which travel through the ether. A good radio set has a very much wider range. Invisible rays may be transformed into visible light (i.e. their wavelength changed) by a fluorescent screen.

INTENSITY OF DAYLIGHT is extremely variable. Below is the record of a photo-electric eye exposed to the sky for a few hours on a cloudy day in June.



***BRIGHTNESS** is the measure of the light that strikes the eye. Naturally the light from a small, compact source will seem brighter (and therefore have a higher ft-L reading) than the same amount of light from a more extended source. A surface emitting one lumen per sq. ft. in a given direction has a brightness of one foot lambert in that direction.
The number of foot lamberts is found by multiplying the foot candles of illumination on a surface by its reflection factor.



Brightness contrasts which are above normal ("glare"), and therefore wearying, can be caused just as easily by wide differences between reflection factors as between amounts of illumination. For example, under the same foot-candle illumination, white paper, with a reflection factor of 80%, will appear four times brighter than a piece of cast iron (reflection factor 20%).

TREES can be most efficient sunshades (without necessarily building *inside* them, as shown above). A full-leaved tree will reduce the light falling on a horizontal surface by 75%. By choosing species according to their date of leafing, the period of shading (the extent, unfortunately, with a young tree will change each year) may be planned to fit a particular need. And, unlike calculated shading by a fixed obstruction, it does not have to be for a period symmetrical about June 21.

Below are listed some common species in the order of their coming into leaf. There is a spread of at least two months between the first and the last. Both order and date of leafing will be affected to a small extent by the weather. In southern New England the catalpa will be in full leaf by early June. Early leafers are early shedders, except for the mulberry which sheds early.

Horse chestnut
Willow
Linden
Maple
Elm
Tulip poplar
Beech
Birch
Ailanthus
Ash
Hickory
Oak
Dogwood
Mulberry
Empress tree
Catalpa

cases chemical action), some are reflected in other directions so that our eyes don't receive them.

The light that finally reaches our eyes has had its quality changed. A red object looks red because it absorbs all the wave lengths of white light except the red. The particles of dust and water vapor in our atmosphere, by subtracting certain sections of the sun's light, give the sky its color; and this "incomplete" light is altered once again when it strikes an object and is finally reflected to our eyes.

A white surface is one that reflects all wave lengths equally, it absorbs none (or almost none; 100% reflection is theoretical only). Black absorbs all. Between these two extremes lies the whole range of colors, each of which will subtract from the original light its own particular wave lengths. The amount reflected will range from about 90% in the case of light-colored surfaces, to around 10% in the case of dark-colored ones.

REFLECTION OF INCIDENT LIGHT depends mainly upon the color and texture of the reflecting surface, is less strongly affected by the angle of incidence and color temperature of the light.

	% of incident light reflected
Light cream	80 - 90
Light green, light ivory, light yellow	40 - 50
Browns, olive green, medium blue	10 - 20
Country landscape: grass, trees, etc	10 - 20

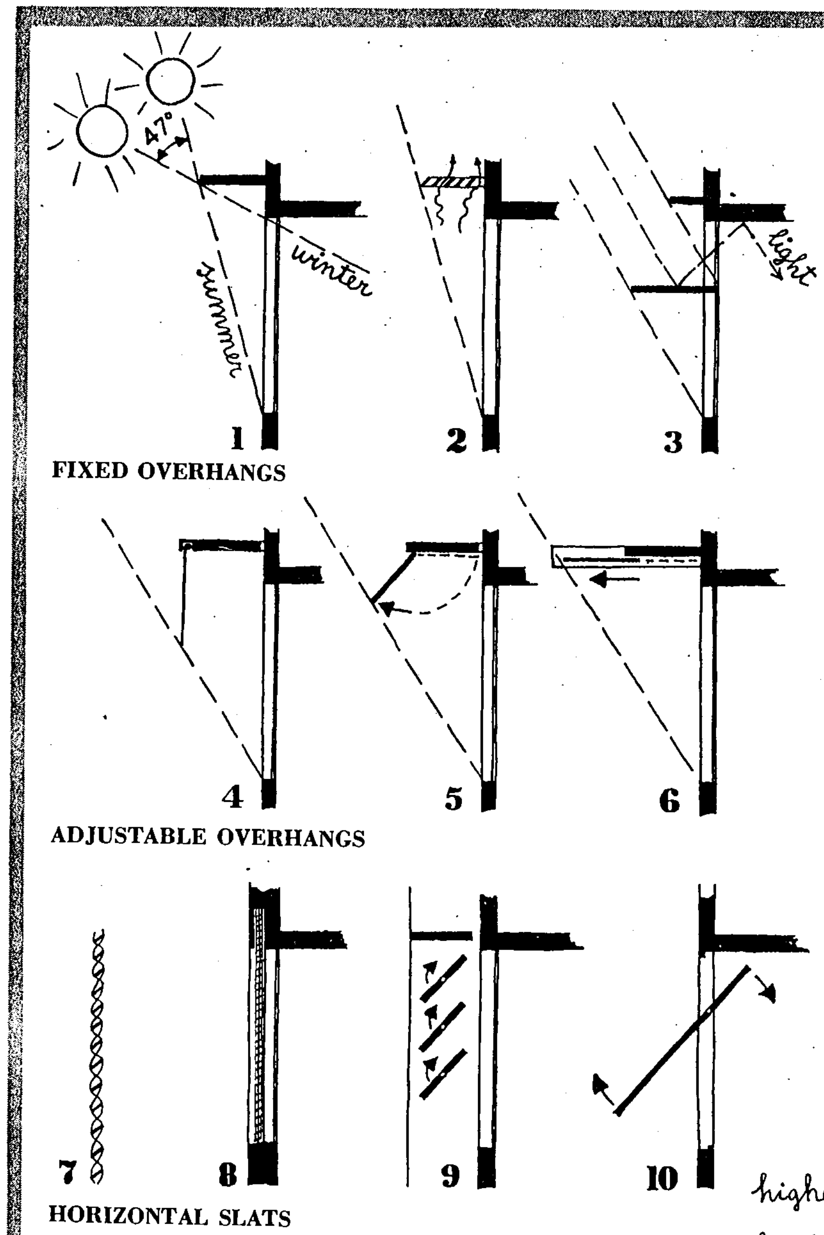
While the source of daylight cannot be controlled, and though even the clouds are still free of man's reaching power, he is able to set up

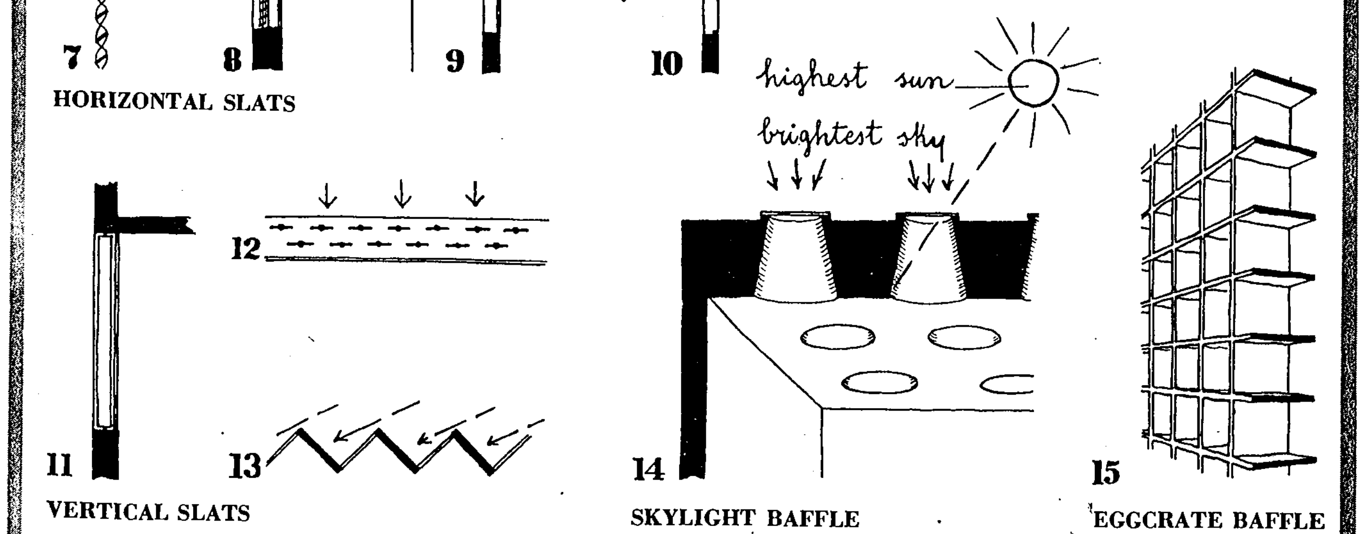
light controls around buildings and within them. The aim of all such controls will be a more even distribution of light within the building to reduce the high contrast between areas near a window and those further back.

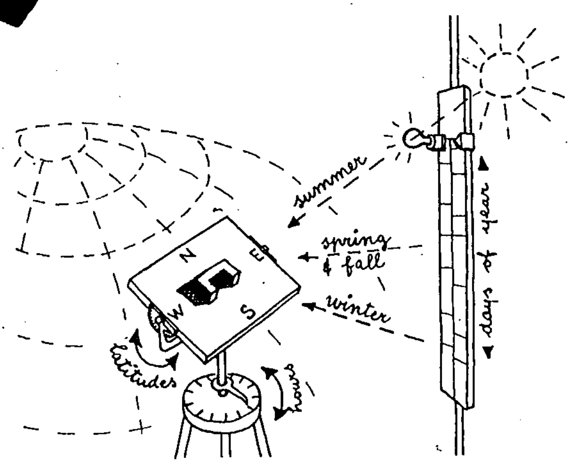
They will be fully effective only if they vary inversely as the light: if a cloud passes across the sun, the shades must adjust immediately. Otherwise they can be used with exact success only for the complete shutting out of daylight. The design of most current sunshades touches haphazardly upon the fringes of the whole complex of light control. On the opposite page are outlined the fundamental devices—almost all custom-made—most widely used.

SUN SHADES

Diagrammatically classified here are some typical built-in sunshades. *Fixed overhangs* must be raised above the window head for full sun penetration in winter. The difference between the sun's altitude at the winter and summer solstices is always 47° anywhere on earth. Improved overhangs slatted, **2**, for air circulation, divided, **3**, to reflect light to ceiling thence to back of room. *Adjustable overhangs* with a roller blind, **4**, a hinged flap, **5**, a sliding flap, **6**. The smallest *horizontal slats* are tiny louvers in an insect screen, **7**. Next is the Venetian blind (metal for outdoors), **8**, then larger slats, **9**, adjusted by hand or photo-electrically according to the changing light. Finally a pivoting (top-hinged if screened) solid wall section, **10**, for use without glass in tropical climates. Where the sun strikes at a very low altitude only *vertical slats* will serve. Sometimes a simple zig-zag of solid and window, **13**, is enough. For air circulation without sun, movable vertical slats must be set apart and wide enough to overlap each other, **12**. The *skylight baffle*, **14**, will be effective only in northern latitudes where the sun's maximum altitude is low (at Viipuri, Finland, it is 53°). A deep-finned *eggcrate baffle*, **15**, will shield unglazed areas from rain and sun.







MAN-CONTROLLED SUN AND EARTH—an electric light adjustable for altitude, and an easel adjustable for azimuth (swing) and latitude (tilt)—are used with building models in the Heliodon. It is particularly useful in the layout of large building groups, where its errors of magnification are unimportant.

WHERE TO PUT THE WINDOW, if even light distribution is your aim, is demonstrated in these section-graphs of illumination intensity. They demonstrate a truth which factory designers discovered long since: that for even, high-level illumination, skylights or monitors are far more efficient than side-wall windows. What is not demonstrated is the human demand for view, and the fast, large decrease of efficiency caused by dirt collection on glass, which can quickly cancel out much of the skylights' advantage.

CONTROLS FOR DAYLIGHT should affect:

the *amount* of light entering the building;
the *direction* of the light rays, and so their eventual position, their place of striking;
the *quality* of light, its color and degree of diffusion.

There are **three methods of control:**

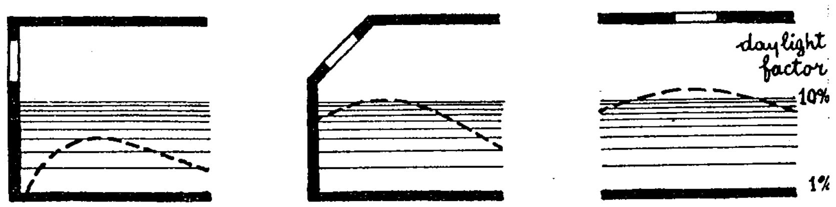
obstruction of the light rays, blocking them off with opaque shields, absorbing them with black matt reflectors, subtracting some of them with colored glass;
redirection of rays by mirror-bright reflectors, or by channeling them through lenses:
diffusion, by passing the light through translucent materials, or reflecting it from matt surfaces, or a combination of both.

Where do you want daylight, and when?

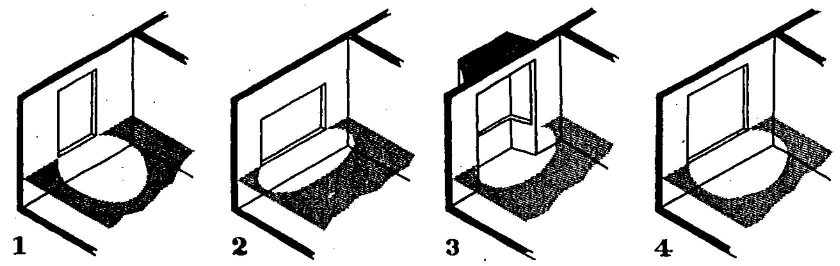
This all starts with city planning. The old standard grid plan may be convenient for the buying and selling of real estate, but it is almost certainly not the best layout for the equable sharing and enjoyment of daylight. The placing of windows within a building is secondary to the placing of the building itself in relation to its neighbors.

Position and shape of window openings, the type of glass—clear, diffusing, or directional—the use of baffles, shades and reflectors—all these are intermediate controls between the source of daylight and the area within a building, or between buildings, which is to be lighted.

The orientation of a window will determine the amount and type of daylight which it may receive. Its potential may be increased by tilting it toward the sky, so that less light will be lost by reflection off the glass. But then the glass will collect more dirt and, unless washed more often, this will outweigh the saving on reflection.



The position of the window opening and its shape—in which must be included any added obstructions such as neighboring buildings, trees, sunshades, etc.—will determine the amount and distribution of daylight within the building.



Bay windows merely increase the depth of the space to be lit; despite their increased glass area, they give less useful light than the same amount of wall opening glazed with a flat window.

The nearer the windows come to the ceiling the further they will throw the light back into the dark center of the building. Directional glass block may be better still, some form of roof light even better. Light-colored paint with a high reflection factor (but not glossy) will also help to spread the light back from the sidewalls.

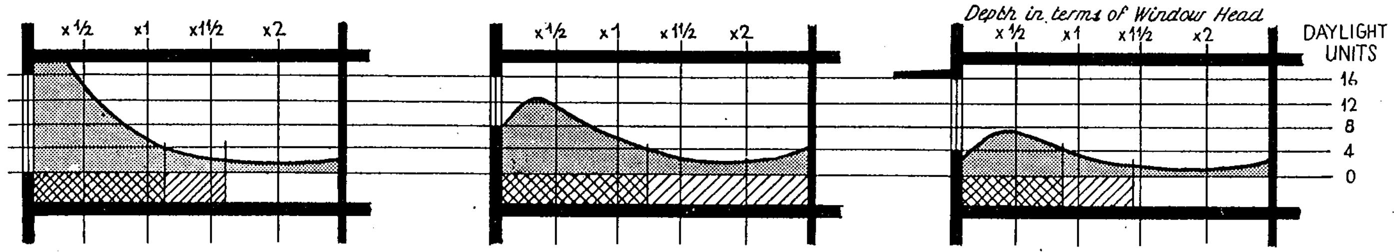
The aim of all these is to even the lighting.

In the design of factories, where these problems have been studied rather intensely, it is found that by using monitors in the roof the maximum illumination is increased very little, but the minimum increases a great deal. Roof lights in other one-story buildings might help to strike an average between too much light near the windows and too little at the center of the building. Large windows far away are less efficient for lighting than small windows nearer; and roof lights have the additional advantage of receiving light from the brightest part of the sky. In overcast weather the sky at the zenith is usually about three times brighter than that at the horizon.

What quality of light do you want?

Direct, intense, warm in color? Or cool, diffused, of low intensity, but widely spread? Even if you know what

WINDOW SHAPE AFFECTS light distribution as well as view. An oblong window set vertically, **1**, will give a deeper but narrower distribution of light than the same size window set horizontally, **2. A** bay window, **3**, contrary to popular opinion, will give less light within the room than an opening of equal size flush with the wall, **4**, in spite of more glass area.

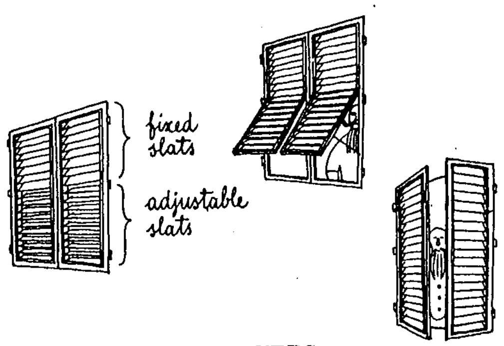


1. ORDINARY WINDOW **2. HIGH WINDOW** **3. HOODED WINDOW**

Adequate Illumination for Close Work — Adequate Illumination for Simple Work

EVEN LIGHT DISTRIBUTION is exceedingly difficult in deep rooms lit from one side only. If it is impossible to cut any windows, even a clearstory, in the opposite wall, then raising the sill height, **2**, is probably the least bad solution in most cases. It reduces excessive brightness near the window wall, but has little effect on the intensity further back in the room. Which suggests that the most efficient shading of big window walls would be by blinds raised from the sill. A projecting hood, **3**, will also even the illumination throughout the room, and without sacrifice of view, for the sill may be lower. However, this arrangement reduces the general intensity to such a degree that less than half the room is adequately lighted for close work.
All three windows are of the same area. The sill in **1** is at working level.

THE SPARKLE OF SUNLIGHT delighted not only the meticulous Dutch painters (left), but also the tidy Dutch bourgeoisie marooned in misty damp polders. Contrast of light and shade, however, can become too strong, particularly in drier climates. So there developed that charming diffusing screen of lace (right), with its added merit of one-way vision.



TRADITIONAL SHUTTERS.
Closed (left) they keep out rain and sun, let air circulate. For more air and some view, the lower half opens awning-wise (center). Swung half open (right) the two leaves act as vertical sun shades.

DAYLIGHT FROM HIDDEN SOURCES in a Gothic nave shows the advantage of deep baffles and clearstory windows.

you want, it may not be too easy to decide on the best way of getting it. The art of daylighting is still in its primitive stage where experiment—not precept—shows the route.

First, for the sake of visual comfort, you will probably decide upon trying to reduce the brightness contrasts within the building. An easy and presently popular answer to this (though a not entirely satisfactory one even in theory) is to increase the amount of window area. This usually means that one whole wall will be entirely of glass. This increases the general level of illumination in the room, and so reduces contrast between inside and out, but it may also accentuate the darkness of the other walls.

Just enlarging the hole in the wall is not enough. Even distribution is also necessary.

The best chance for creating a perfectly balanced system of daylighting would be by the complete exclusion of direct sunlight. This is particularly true in the upper stories of high buildings, where there is no light thrown upward from the ground outside to balance the strongly directional light coming in from the sky.

Control would be by reflectors and diffusers, adjustable for position, color and surface texture. Many centuries ago the traditional shutter with movable slats painted green had already arrived at some of the results which lighting engineers now find necessary for comfortable environment.

Whereas in factories and workrooms even lighting is essential, in private houses (were it in fact possible to achieve) such lighting might well be felt dull, flat, uninspiring. The stimulating, warm contrasts of direct sunlight may be quite necessary for human well-being, particularly for the modern indoor-outdoor mode of living. However, the harsh and glaring brightness contrasts that lead to the use of dark glasses, are tiring and painful.

So we should perhaps set up two different environments within the building, one with brightness contrasts not very much lower than those found in Nature on an evenly lit day, the other—further within the house—with lower brightness contrasts. This latter area would have as even and carefully modulated lighting as the vagaries of clouds and sun movement will allow. There will still remain the difficulty of transition from indoors to out and vice versa, due to the slowness with which the eye adapts itself to changing brightness levels.

VIEW is a specialized form of reflected light.

It is usually considered separately from daylight control; perhaps wisely, because it is more often than not in conflict with the devices (louvers, shades, etc.) necessary for such control. View is an emotional desire, light control a set of scientific calculations. When light control demands a clearstory, emotion demands a picture window.

Scientific investigators are doubtless correct in claiming that an occasional distant view is essential for resting the eyes. But it is not as simple as that. What we need is an occasional view of Mr. Abraham's magnolia tree, of that pretty Janet Masters, of Henry Wilson's new Chevvy. We don't complain if some of the sky view is cut. But, unfortunately, for more even illumination (i.e. more light at the back of the room) the sky view should be left open, the interesting part of the view closed off.

Do you want the most extensive possible view by means of glass walls? Or a carefully framed segment of the view in each of a series of windows? A view lit from side and front will be much richer in color and depth than a southern view lit mainly from back and top. And what sill height is best for view?

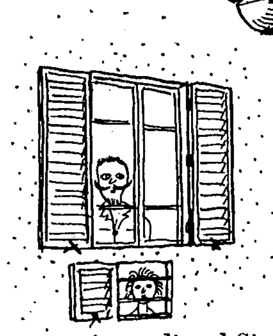
"There is no subject connected with landscape gardening of more importance . . . than the window through which the landscape is seen . . . There is a circumstance relative to windows which is seldom attended to . . . viz., the situation of the bar, which is too apt to cross the eye, and injure the view, or landscape. This bar ought never to be more than four feet nine inches, nor less than four feet six inches from the floor; so that a person in the middle of the room may be able to see under the bar when sitting, and over it when standing . . . If it can be entirely omitted, the scenery will be improved . . ."*

The window shape may be adjusted to the character of the view—a horizontal window strip for a wide flat landscape, a series of separate vertical panels for a cabin in the forest. Perhaps a time will come when people will not be quite so frightened of a picture window being too small.

A miniature may be just as beautiful as a mural.

At night the beautiful view appears as a black blank, an extravagant light leak. A light-colored shade over the window (the same shade used for light control perhaps) is the best way of restoring the room lighting to normalcy.

*Humphry Repton, *Fragments on the Theory and Practice of Landscape Gardening*, 1816.



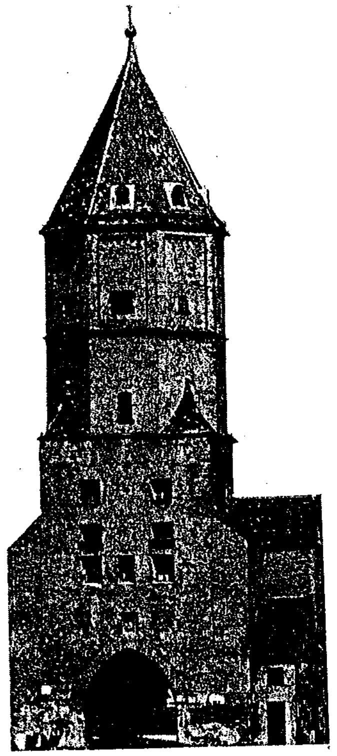
VIEW WAS A PRIVILEGE in medieval Siena, a privilege granted to young as well as old. Children's windows were cut into the walls below or beside the windows used by adults.

FRAMING THE VIEW used to mean excessive contrast between dark wall and brightly lit window (which often prevented the view being seen at all). But the *trompe l'oeil* effect of a missing wall misses also the opportunity of heightening the view's effect by punctuation.

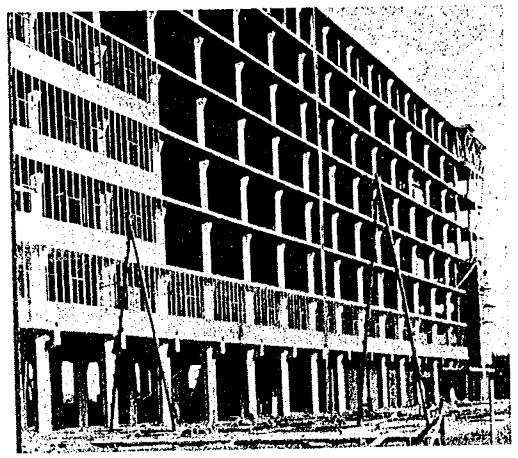
No, not this

But this?

. . . or something else again?



THE SOLID WEIGHT of a masonry wall, laboriously piled together, is emphasized by contrast with small window openings, and deep reveals which fill each opening with black shadow.



THE SKELETAL GRACE of the modern steel and concrete frame building is best analyzed during construction. It can be seen that the skin material, fixed here to the edge of cantilevered floors, has nothing to support except its own weight, wind pressure, and mistreatment by the inhabitants.

And now to consider some of the truths, half-truths, and prejudices—mostly based in history—which tend to becloud judgment and suppress reason in the design of fenestration.

Efficient design of windows and fenestration is still hampered by the lack of clear, comprehensive thinking among the designers, who are in turn hampered by ignorance and half-truths about the basic physical facts of daylighting which we have outlined in the preceding pages.

The designers' outlook is also influenced by their position in the train of history. Which is as it should be; for to forget the past would be as foolish as to ignore the future. Then education leaves further deposits in the mind, until finally each designer has gathered his own little collection of prejudice and anti-prejudice.

This usually coalesces around some or all of these four considerations: windows as façade decoration, the technical complications of making a hole in the wall and finding a durable translucent material with which to fill it, social, political and moral influences, and the window as ventilator.

1. Windows as a façade decoration.

As long as glass-filled windows are used in juxtaposition with solid walls, every building designer worthy of the name will exploit that texture difference to the utmost. It is a legitimate and appropriate way of giving character to his building.

The window is always rightly described and used as a façade decoration.

The walls of the past, being structural, express their massive nature by the contrast between solid and void. Deep reveals lend mystery to the black-appearing glass within the recess of the window. The façade has the depth, texture and strength of a solid.
One can *feel* the weight of that bounding wall. One can imagine the privacy of inside chambers withdrawn from the clamoring world outside.

Now, with modern structural methods based on the use of frame construction,

wall and window are but two textures of the same thin skin.

Structurally neither are of any significance when put in comparison with the bearing wall. Improved materials are making the skin ever thinner and more efficient.

The pressure of commercial economy for the utmost floor area within a limited and expensive plot causes the skin to be put on the outside face of the frame, or even cantilevered out from it.

The glass exposed on the surface reflects but grayly. It has been stripped of its mystery and dark contrast; it depends now upon its texture, shape and transparency.

Obviously this revolution in materials and structure must be reflected in the facade. It is one of those indices by which we mark the historic styles.

The van Nelle tobacco factory in Rotterdam, or a house by Marcel Breuer, are just as typically of our age as Raphael's Villa Farnesina is typical of the later Italian Renaissance, or a Norman castle of 12th cent. England.

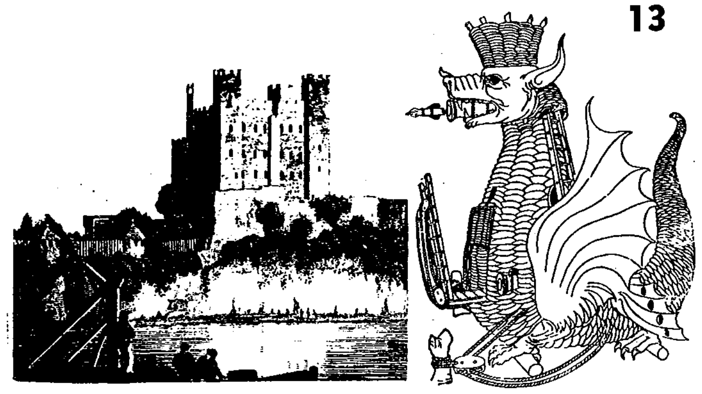
But the designer's approach was different in each case.

The façade of Raphael's villa was designed in conformity with a rigid set of rules governing its style and proportions. These rules were derived from a study of Roman architecture (mostly public buildings which were impossible to imitate exactly because they didn't have chimneys or windows suitable for villas), and commonly accepted by all the leading architects of that period.

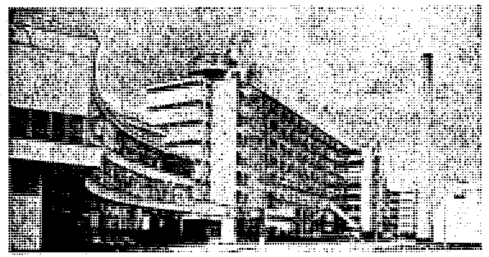
The Norman castle was designed primarily to repel enemies. It was what we have become used to calling a **functional** building. The builder built the castle in the style which he thought would most effectively stop arrows, scaling ladders, battering rams. The proportions were governed by anticipated use, not by what the builder thought the Romans might have done.

Like the Norman castle, the modern building is free of pre-ordained restrictions (theoretically at least). Raphael was forced to work from the façade to the plan; **the modern architect prides himself on working from the plan to the façade.**

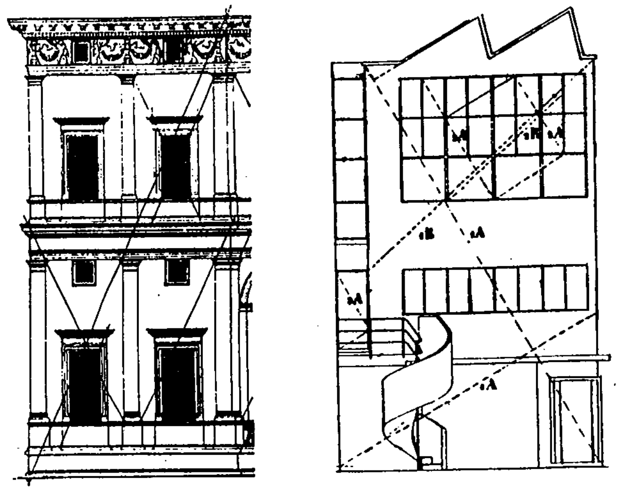
Though modern building does not derive from Vitruvius it very often derives from Mondrian. A conscious, painterly asymmetry is the present vogue, dynamic rather than static balance. This corresponds to the dissolution of the fixed building cube, and the interpenetration of transparent masses which glass, and other newly-developed sheet materials, makes possible.



DESIGNED FOR EFFICIENCY, the Norman castle had to repel the symbolic monster at right. The walls were thick and the windows narrow for the same reason that in the van Nelle factory (below) the walls are thin and almost all glass: the designer in each case was trying to design the most efficient and best-looking structure for its purpose.

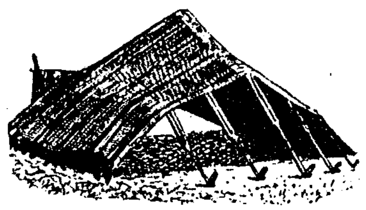


Raphael Le Corbusier

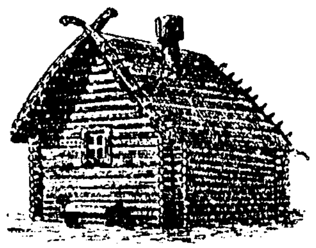


DESIGNED TO CONFORM to a system of proportions. Unlike most modern architects, Le Corbusier, in the Classical tradition, prides himself on following *Traces Régulateurs* (now condensed in the Modulor rule), though these appear justification rather than precept.

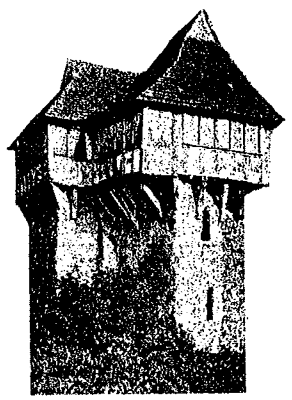
FRAME CONSTRUCTION is indigenous to the U. S. When Capt. John Smith landed in Virginia he found the Indians living in houses of light wood frame covered by sheets of bark and skin; but no glass.



IN THE DESERT, roof and walls in tension; for large, unglazed openings.



IN SIBERIA, large windows discouraged by intense cold, lack of glass.



MEDIEVAL RIBBON WINDOWS blossomed above the thick walls, slit windows, needed for defense. Today large clear glass sheets and steel's high tensile strength make structural mullions, leaded glass lights, anachronistic.

2. The technical complications of making a hole in the wall, and finding a translucent material with which to fill it.

As long as the outer walls of buildings were carrying the load, and the common building materials stone, brick and sod, it was comparatively difficult to make large openings in the walls. And if it were possible to make the hole without danger of the wall's collapse, what material was there which would transmit light yet close the opening against weather and heat loss?

The Eskimos were the only people with a suitable material which was right on the building site and easy to procure. They have been making windows of ice for as long as they have been making their domed igloos. Unfortunately they last only a single winter.

Glass has been manufactured for almost 4,000 years, but it is only since the end of the 19th cent. that it has been available in larger and larger sheets, of good quality, at a comparatively low price. This all traces back to improved manufacturing technique.

When glass was high-cost and low-quality, giving a distorted view even in small pieces, then the small-paned window was reasonable. Its use today is pure affectation, an aesthetic tradition without structural reason for being.

The modern frame building not only makes possible openings of almost unlimited size, it has the additional advantage of putting almost no limits on the disposition of transparent and opaque skin sections. In a bearing wall structure the solids are immovable. In a frame structure with a skin all of glass, light movable screens of some opaque material could take the place of solid wall.

Tradition (often enshrined in the Building Code) is the main reason for such missed opportunities, the lag between invention and fulfilment in use.

However, just because the modern frame building puts almost no limitation on the size and position of clear openings, and just because modern plate glass sheets put almost no limit on size and clear vision, these advantages should not be exploited without due thought and reason. "In many a modern house the use of glass seems to be taken as a point of honor, as an article of faith, so to speak, the credo being to enlarge the area of the window openings to the utmost. Such exaggerations grow only from the wish to revel in technical novelties, and to boast of the charm of new materials."*

The owners follow close upon their architects' heels in proclaiming the virtues of the fixed window wall, even as they fetch the mop and pail for the condensation, even as they cast a shawl around their shoulders in the evening to protect themselves from the cold which strikes them on the window side. Let us admit it,

many a sweet-looking window wall has gone sour. Even sealed double glazing has a much greater heat loss than a poorly insulated solid wall. Radiant heat coming through the glass from the sun must be anticipated and controlled, if it is to be turned to advantage. Too much daylight, if it increases the brightness contrast, is more likely to cause discomfort than too little. Yet all these possible disadvantages can be turned to advantage by a designer with the necessary knowledge and foresight.

Large windows, provided that they are fitted with adjustable shades, have the same merits as high water pressure or oversized electric wiring: they allow for emergencies—for dull days when you need more light, for sunny days in winter when you need more warmth—even though for all the rest of the time the shades may be partly closed.

Social, political and moral influences.

First it was arrows that we didn't want to let in, then it was the nosey peering of our gossipy neighbors, then we just wanted some place where we could get away from it all without the necessity of joining Paul Gauguin in Tahiti. Then finally we were persuaded that sunshine was more important than any of these (though a few hundred years earlier we had been equally decided that sunshine was very dangerous because it caused decay in the garbage dumps), and now at last we open the walls with glass, even though the glass be fixed shut.

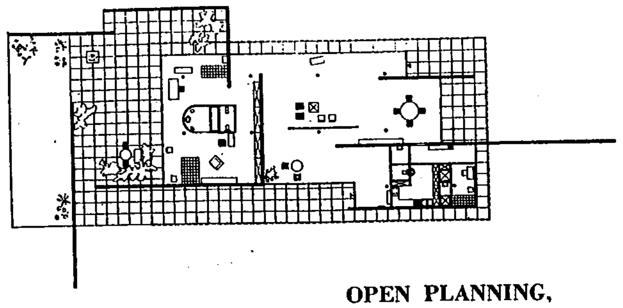
Then, just yesterday, we began to wonder . . .

What had happened to our privacy?

A modern critic*, questioning but not positive, writes of the Tugendhat House by Mies van der Rohe, one of the earliest and most complete expositions of open planning, with glass walls and interpenetrating spaces, one flowing into the other without solid bounding walls ". . . regarding the complete loosening of the walls in the lower floor, one

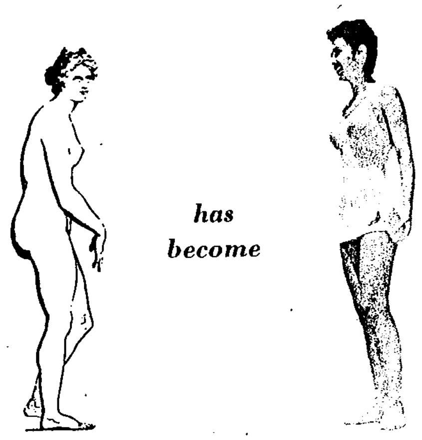
*W. C. Behrendt, *Modern Building.* Harcourt Brace & Co.

LIVING IN A GLASS SHELL in northern latitudes is comforting for tropical plants, but not for humans — without elaborate air conditioning. The visitors to Paxton's Great Exhibition hall were extremely grateful for the shade of the tall elms around which the glass vault had been assembled.



OPEN PLANNING, with the architect constructing interpenetrating spaces as the abstract artist would portray them, is most completely accomplished by one of its earliest masters, Mies van der Rohe.

A SINGLE HOLE, at top center of each earth hut, serves as entrance door, window, chimney, fulfills no one of these functions with real efficiency.



EVEN THE HUMAN FIGURE, upon which the Renaissance humanists based their systems of proportion, *has changed.* Our present-day goddess of beauty is taller, slimmer, than a classic Venus.

might doubt whether such an interior can still afford that comfortable feeling of being sheltered which, after all, we are supposed to expect from a house. . . . In former times, space dominated man, and he found his happiness in submitting himself in his own room to the autonomy of its geometric laws. In modern times man dominates space, and consequently he also denies its limits in his own rooms."

The desire for light, like the insatiable desires for liquor and tobacco, has always made window glass a popular object for taxation. In England the window tax, first imposed in 1695, was not repealed until 1845. In the U. S. glass was taxed not only by the local authorities but also by the English king, who prohibited the manufacture of glass in case it might compete with the British exports. As a result small windows were normal among the early Colonial houses. But that is scarcely a good reason for continuing their use today.

4. The window as ventilator

In most primitive houses light percolated through a hole in the roof, where the smoke went out, and through a hole (which could be closed) in the sidewall which served also as a door. Air and light came and went through the same openings, which could be closed with an opaque flap.

When the smoke was led out through a chimney, and window openings, in addition to the door opening, were cut in the walls, it seemed logical to use these same openings for ventilation. For it was not easy to make a weather-tight joint between window and wall, nor between window frame and sash. So there was no inclination to multiply the number of openings.

The Renaissance window, which finally developed from considerations of this sort, is a remarkably ingenious design, particularly as so many functions are combined within this single wall opening. The window is transparent to allow passage of light. There are adjustable openings for ventilation, and there will be some device for controlling light intensity, either blinds, curtains, or louvered shutters. In modern times we have added to this window screens and storm sash, but

it is still proportioned and detailed to fit a facade in the Renaissance tradition of voids and solids. And this is the residential stock window of the catalogs. It is hardly surprising that many modern architects prefer to use "commercial" windows for the few opening sash which they provide.

The amount of fresh air necessary for healthy ventilation is very small unless there is a cabbage boiling on the stove.

The psychological need for fresh air moving through the room is very much more important.

It is for this reason that the most appreciated openings are those in the center of the wall at the "level of occupancy". For the most effective ventilation the fresh air should be introduced at floor level and allowed to escape at ceiling level, thus harnessing the natural upward movement of the heated air.

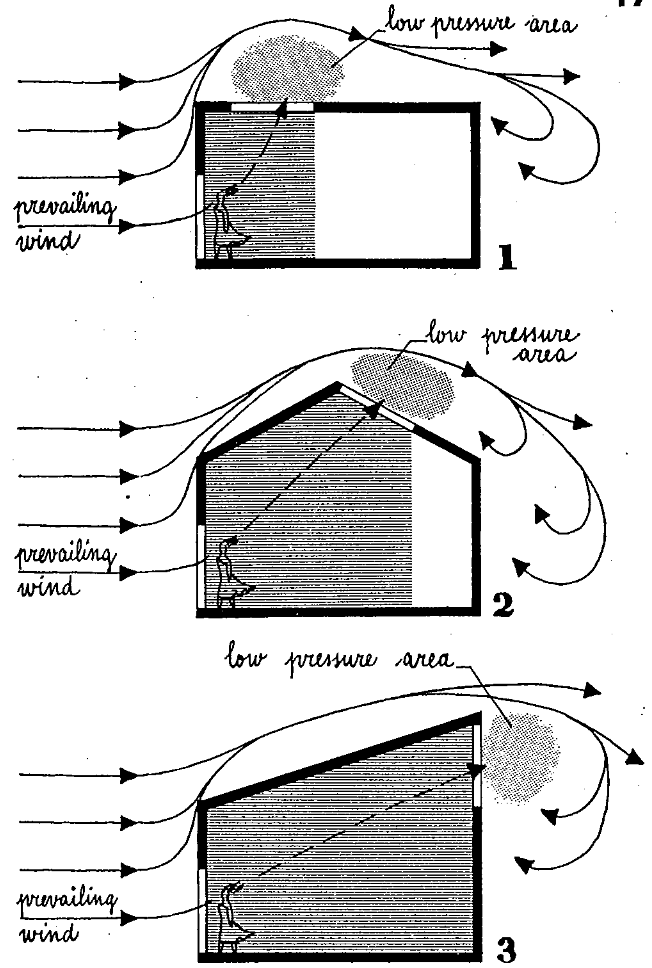
To boost the movement further, orientation is most important, so that the openings will be on the windward side to catch the prevailing breezes. And a commonly disregarded essential is to have an opening to let the air out as well as one to let it in. Inlets and outlets should be of equal area, but the air will be more effectively sucked out if the outlet is placed in the low pressure area which is always formed above or beside the roof.

With central heating systems automatically controlled and supplying specially treated air in controlled amount, it is no longer logical to combine lighting and ventilation as does the opening sash.

Ventilation should logically be combined with heating, and natural lighting correlated with artificial lighting.

For saving wall space in a small room with large windows, or for joy in the feel and smell of fresh air as it comes flooding in the windows, for these the window-ventilator is necessary. And necessary adjunct of the window-ventilator in this country is an insect screen, which reduces incoming daylight by a half, and does even more damage than that to the view. Fixed sash have the great virtue of requiring no screens.

There is no formula here. **Each job must be judged on its own merits, its fenestration decided by a clear, informed mind** without forgetting that thermometers, light meters, and aesthetic canons are nothing more than man-made criteria. They cannot measure subjective sensations, and they are incapable of creation.



NATURAL CIRCULATION OF AIR, "for psychological reasons", should be at the level of occupancy and on the windward side, so that the air's refreshing movement is immediately felt on the face and body. For the greatest air flow per sq. ft. of opening, inlets and outlets should be of equal area; the outlet should be as high as possible above the inlet (so that temperature difference will boost air circulation), and for maximum exhaust effect the outlet should open on to the low pressure area which forms on the roof, 1 and 2, or at the top of the wall, 3. Shaded areas are those which have good natural air circulation under the conditions pictured.

Foot lamberts, light intensity, glare?

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DETAIL

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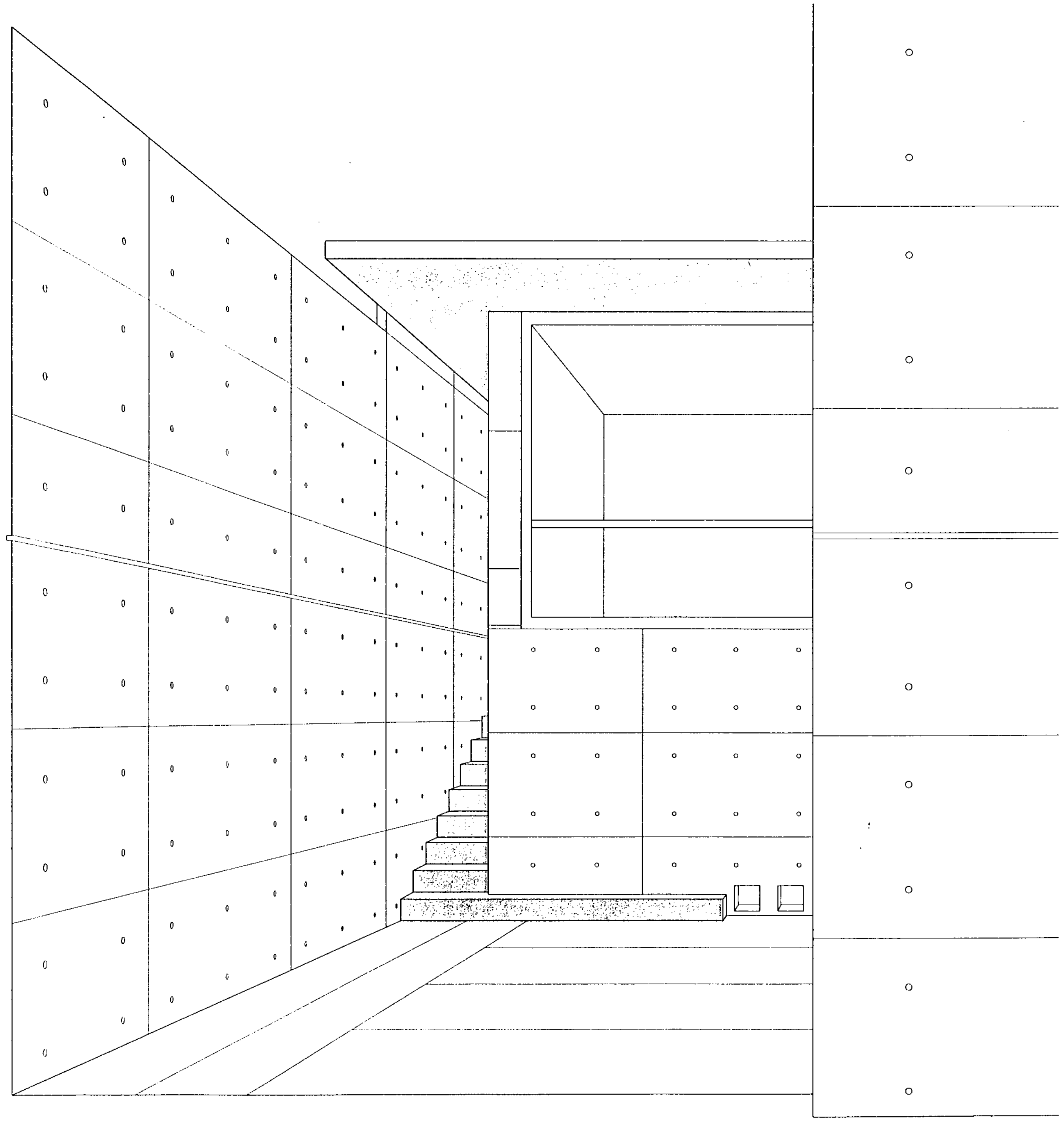
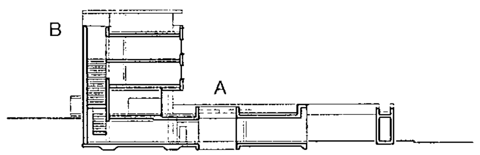
Serie 1997 · **8** · Bauen mit Beton · Concrete Construction · Construire en béton



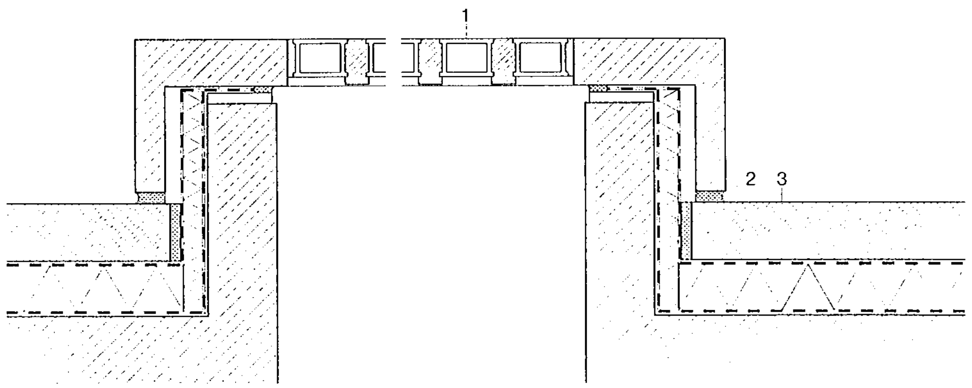


Gebäudequerschnitt bb Maßstab 1:1000

Cross-section through building scale 1:1000

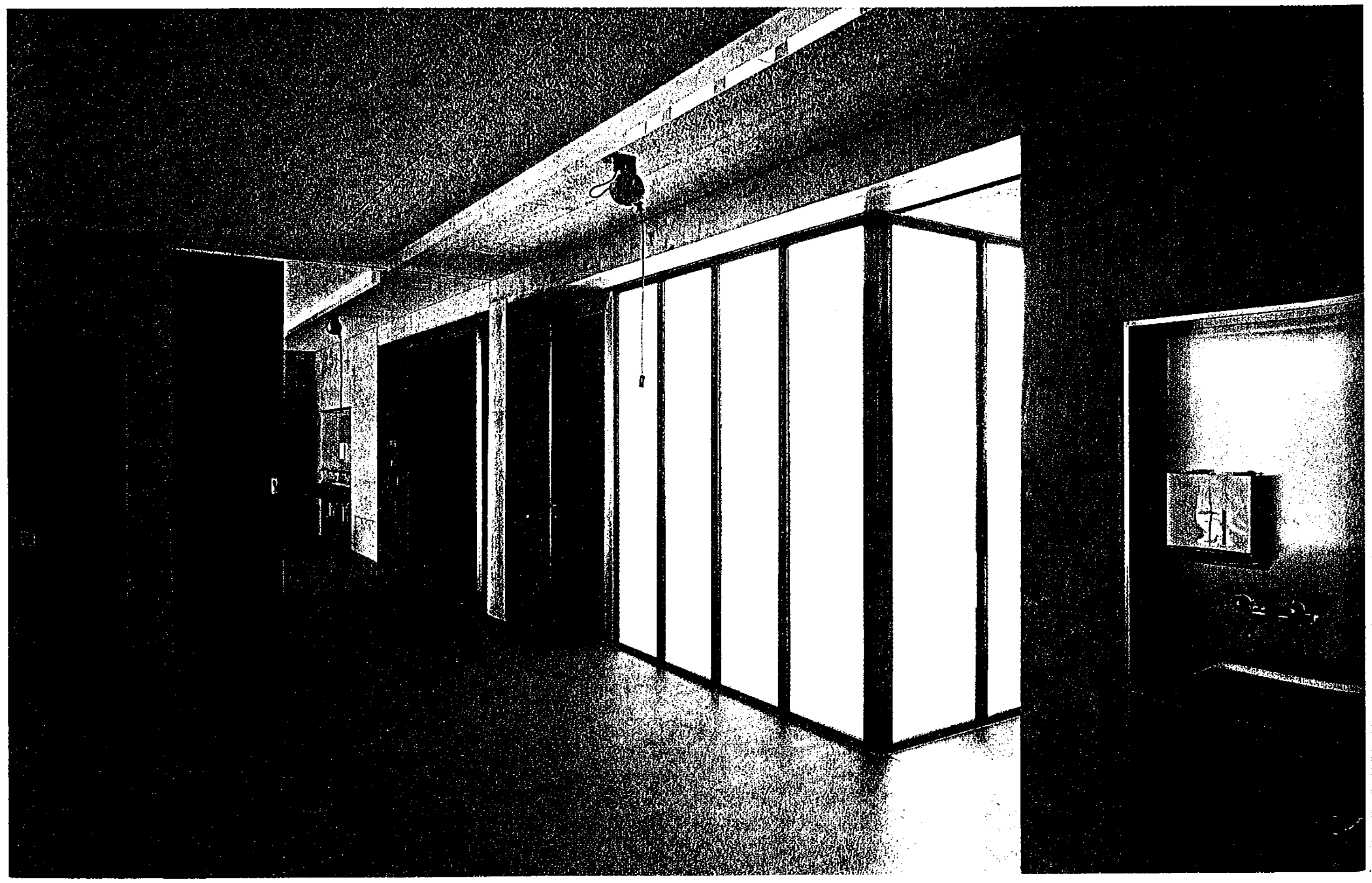
A Schnitt Oberlicht Pausendeck Maßstab 1:20

A Section through roof light in play deck scale 1:20



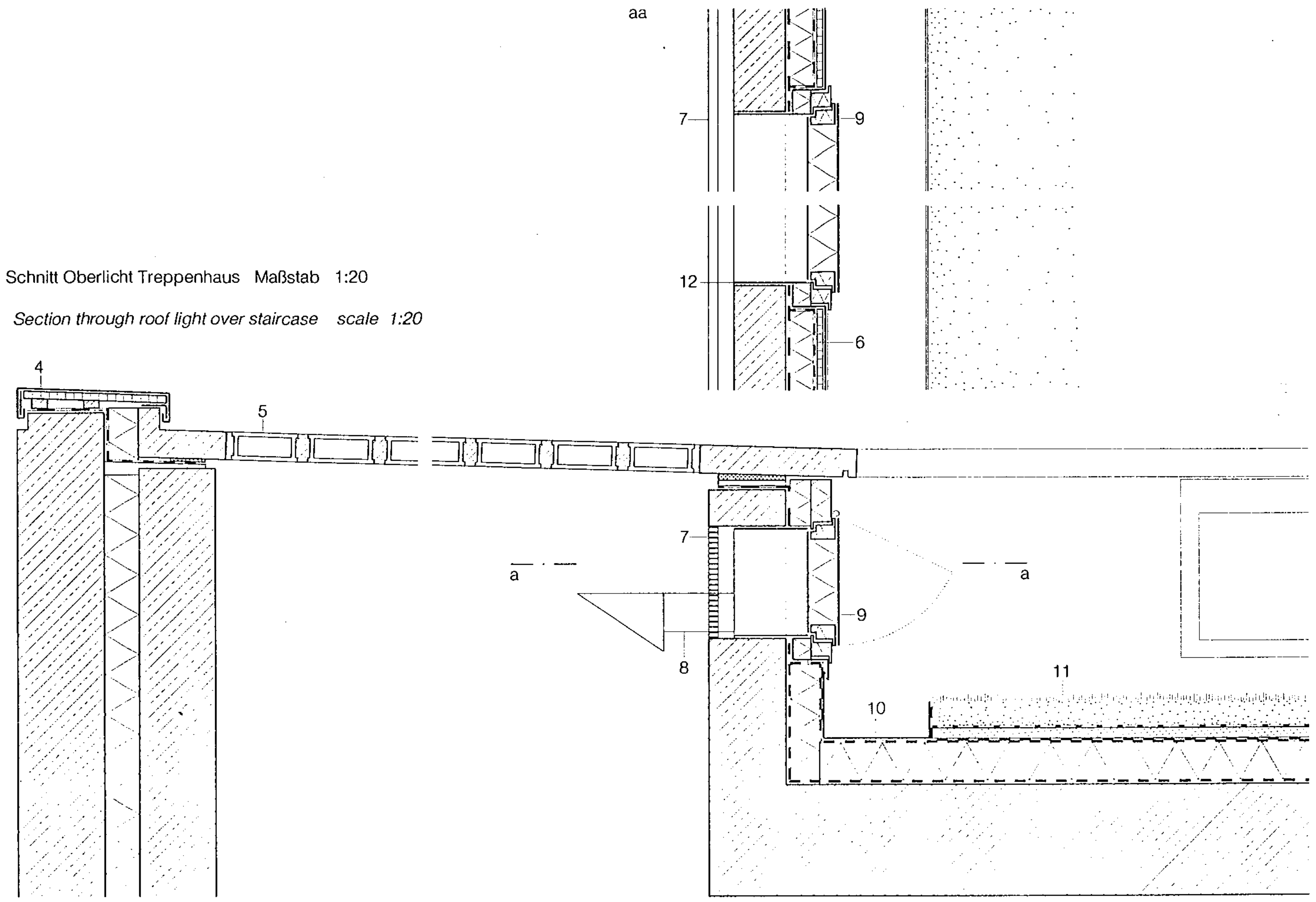
1 Glassteine 140/140/100 mm, begehbar, in Betonraster d = 50 mm
2 Kittfuge
3 Dachaufbau:
Hartbeton 150 mm
Feuchtigkeitssperre
thermische Isolation 120 mm
Dampfsperre
4 Abdeckung, Titanzinkblech
5 vorgefertigtes Glassteinelement d = 80 mm mit 3% Neigung, auf Hartgummiauflager, Feuchtigkeitssperre und Betonglattstrich
6 Sperrholzplatte, Unterkonstruktion für Blechbeschlag
7 Aluminium-Horizontallamellen
8 Halogenleuchte
9 Lüftungsflügel, eloxiertes Aluminium, motorbetrieben
10 Rinnenblech
11 extensive Dachbegrünung
12 Stahlzarge

1 140/140/100 mm glass blocks to bear foot traffic, in concrete grid frame
2 mastic jointing
3 roof construction:
150 mm granolithic concrete
waterproof membrane
120 mm thermal insulation
vapour barrier
4 titanium-zinc sheet covering
5 80 mm prefabricated glass-block element laid to 3% falls on hard rubber bearers, moisture seal and smooth mortar bed
6 plywood panel with sheet metal lining
7 horizontal aluminium louvres
8 halogen lamp
9 anodized aluminium motor-operated ventilation flap
10 sheet metal gutter lining
11 extensive roof planting
12 steel frame



B Schnitt Oberlicht Treppenhaus Maßstab 1:20

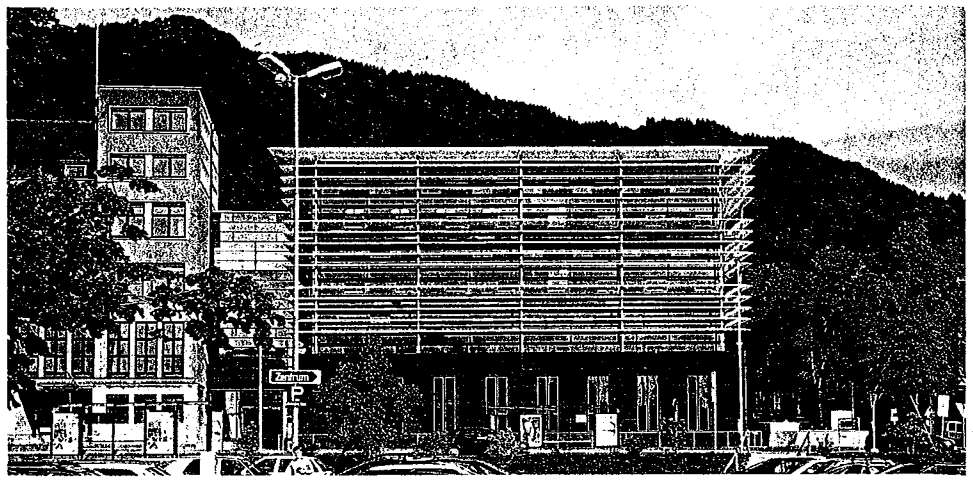
B Section through roof light over staircase scale 1:20



Erweiterung der Höheren Technischen Lehranstalt in Bregenz, Österreich

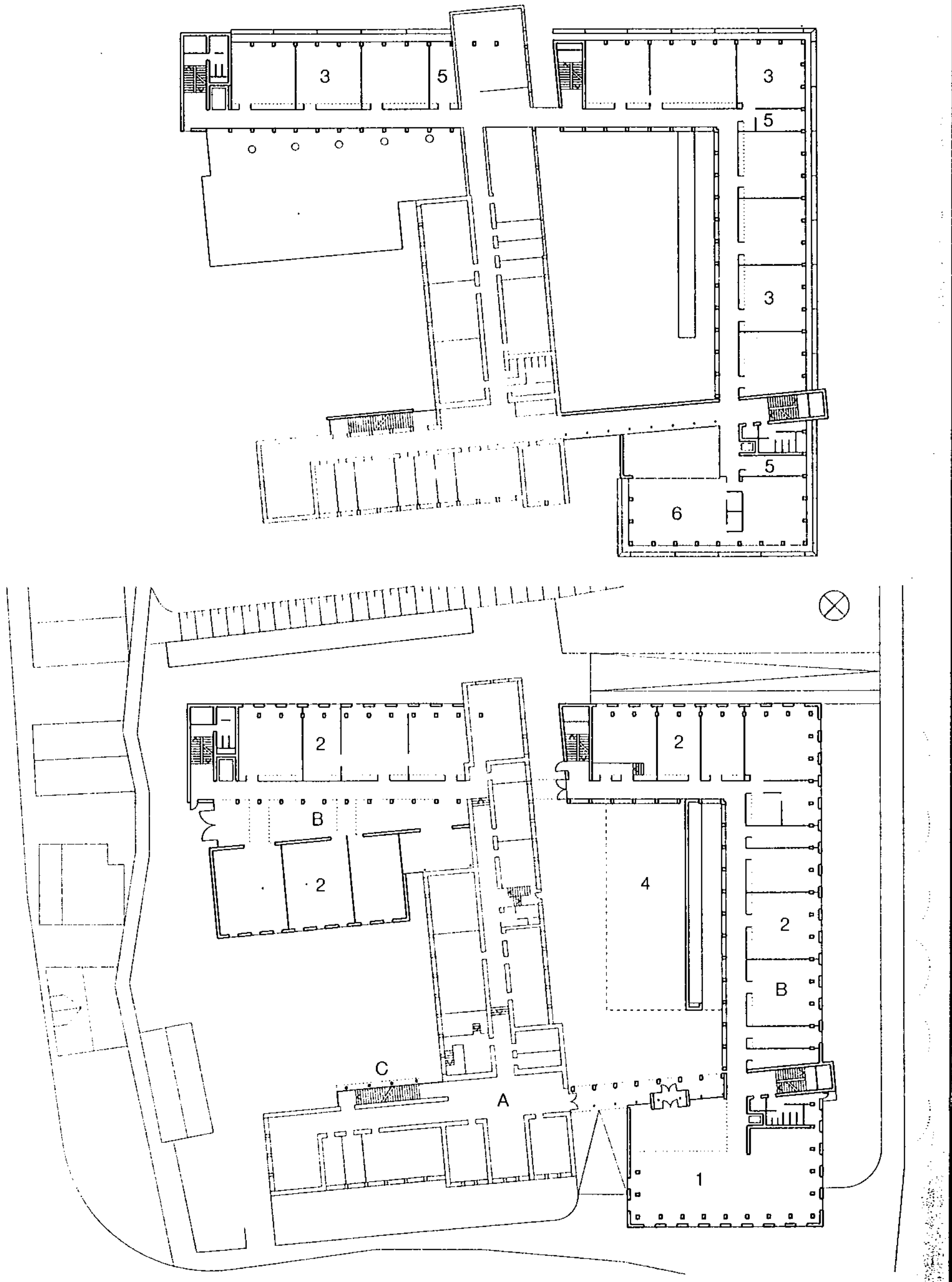
Extension of Higher Technical College in Bregenz, Austria

Architekten:
Architektengemeinschaft
Baumschlager-Eberle, Norbert Schweitzer, Lochau
Mitarbeiter:
Michael Ohneberg (Projektleitung)
Tragwerksplanung:
Plankel, Bregenz



Bei der Erweiterung der Lehranstalt waren in erster Linie eine große Zahl von Klassen- und Werkräumen notwendig, außerdem die entsprechenden Lehrerzimmer sowie Nebenräume. Der neue Bau folgt zunächst dem Straßenverlauf und umfaßt dann das bestehende L-förmige Gebäude so, daß eine Blocksituation mit zwei unterschiedlichen Innenhöfen entsteht. Die Ecke des Blockes wurde deutlich dichter an die Straße gerückt als die bestehende Fassade und betont so noch die Torsituation, die dem Ensemble durch seine Lage am Eingang zur Innenstadt zukommt. Von außen zeigt der Neubau über einer Sockelzone aus schwarz eingefärbtem Beton weiße Metallamellen, welche die verglasten Obergeschosse umfahren. Der offene, nordöstliche Innenhof wird auf einer Seite von einem zweigeschossigen Werkstattgebäude aus schwarzem Sichtbeton begrenzt, auf der gegenüberliegenden Seite durch eine vor dem Altbauflügel aufgestützte mehrgeschossige Betonscheibe, hinter der sich ein neues Fluchttreppenhaus befindet. Einen völlig anderen Charakter hat der geschlossene südwestliche Hof, in den man beim Betreten des Gesamtkomplexes zuerst gelangt. Hier dominiert das kräftige Fassadenraster aus maisgelb eingefärbten Betonfertigteilen, die vor der Verglasungsebene stehen. Eine Sekundärstruktur aus Holzrahmen und Glasflächen entsteht durch die weitere Unterteilung der Rasterfelder in öffenbare, festverglaste und opake Elemente unterschiedlichen Formats.

Distinguished outwardly by a black concrete plinth zone surmounted by a skin of white metal louvres over the glazing to the upper floors, the extension is wrapped round the existing L-shape structure. The open north-east courtyard is defined on one side by a two-storey workshop building in black exposed concrete and on the opposite side by a concrete slab extending up the face of the existing tract. Behind this slab is a new escape staircase. The closed south-west courtyard has a quite different character. It is dominated by a bold grid of yellow precast concrete elements set in front of the plane of the glass. A secondary structure is created by the subdivision of the grid with timber frames into areas of glazing of different sizes.



Grundrisse
Maßstab 1:1000
Obergeschoß, Erdgeschoß

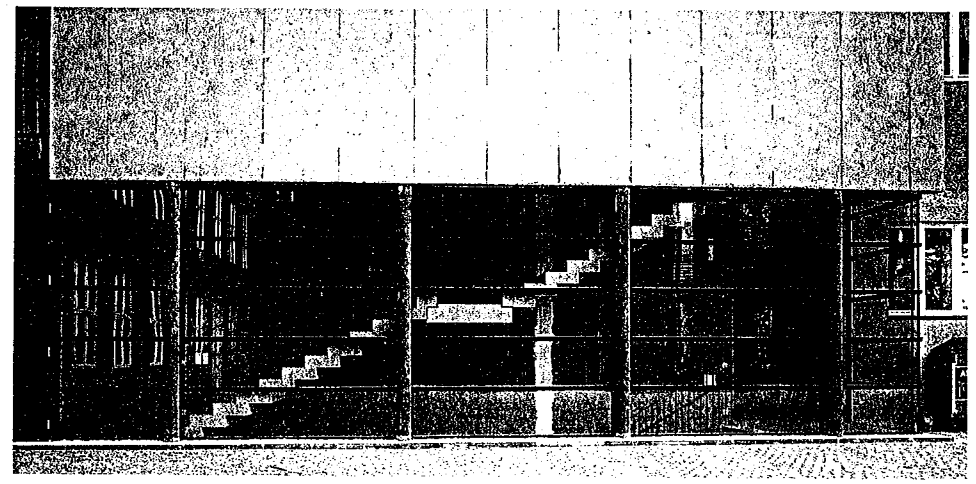
A Altbau
B Neubau
C neue Fluchttreppe

1 Eingangshalle, Buffet
2 Werkräume
3 Klassenzimmer
4 Turnsaal im Untergeschoß
5 Lehrerzimmer
6 Zeichensaal

Plans
scale 1:1000
Upper floor • Ground floor

A Existing building
B Extension
C New escape stairs

1 Entrance hall, buffet
2 Workshops
3 Classrooms
4 Gym in basement
5 Teachers' room
6 Technical drawing studio



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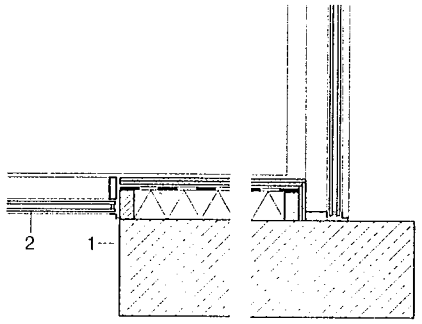

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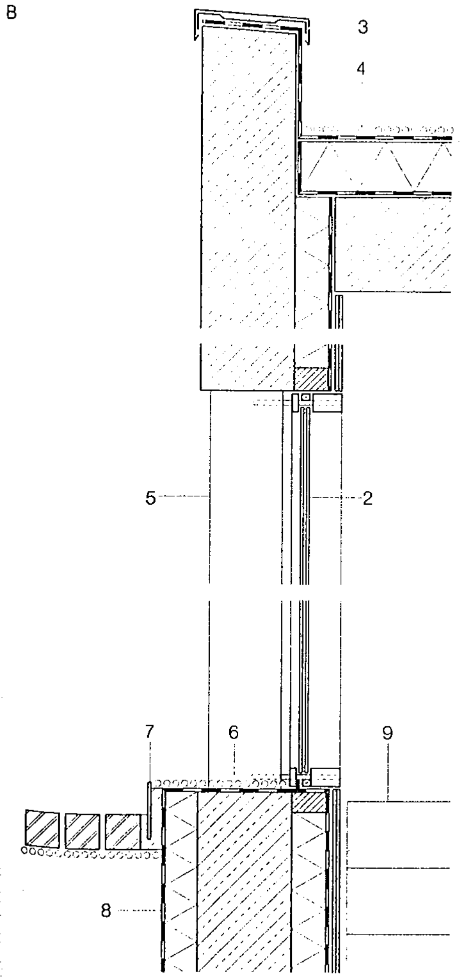

Fassade Fluchttreppenhaus Schnitte
Maßstab 1:20

A horizontale Anschlüsse Verglasung
B Vertikalschnitt

1 Sichtbetonscheibe 250 mm
2 Isolierverglasung in Aluminium-Riegelsystem
3 Titanzinkblech gekantet
4 Kiesschüttung auf Abdichtungsbahn
5 Rundstütze Sichtbeton Ø 200 mm
6 Kies, weißes Rundkorn Ø 4–8 mm
7 Stahl-Einfassungsblech in Mörtelbett fixiert
8 Aufbau Kellerwand: Abdichtungsbahn
Hartschaumdämmung 80 mm
Stahlbeton 250 mm
Mineralwolldämmung 120 mm
Dampfsperre
Gipskartonplatten 2× 12,5 mm
9 Treppenstufen, Betonfertigteile

Façade to escape staircase: sections
scale 1:20

A Horizontal abutment of glazing
B Vertical section

1 250 mm exposed concrete wall slab
2 double glazing in aluminium post and rail system
3 titanium-zinc capping bent to shape
4 gravel layer on waterproof roof sheeting
5 200 mm dia. exposed concrete column
6 white round gravel 4–8 mm dia.
7 steel sheet edging bedded in mortar
8 basement wall construction:
waterproof sheet seal
80 mm rigid foamed plastic insulation
250 mm reinforced concrete wall
120 mm mineral-wool insulation
vapour barrier
2x 12.5 mm plasterboard
9 precast concrete steps

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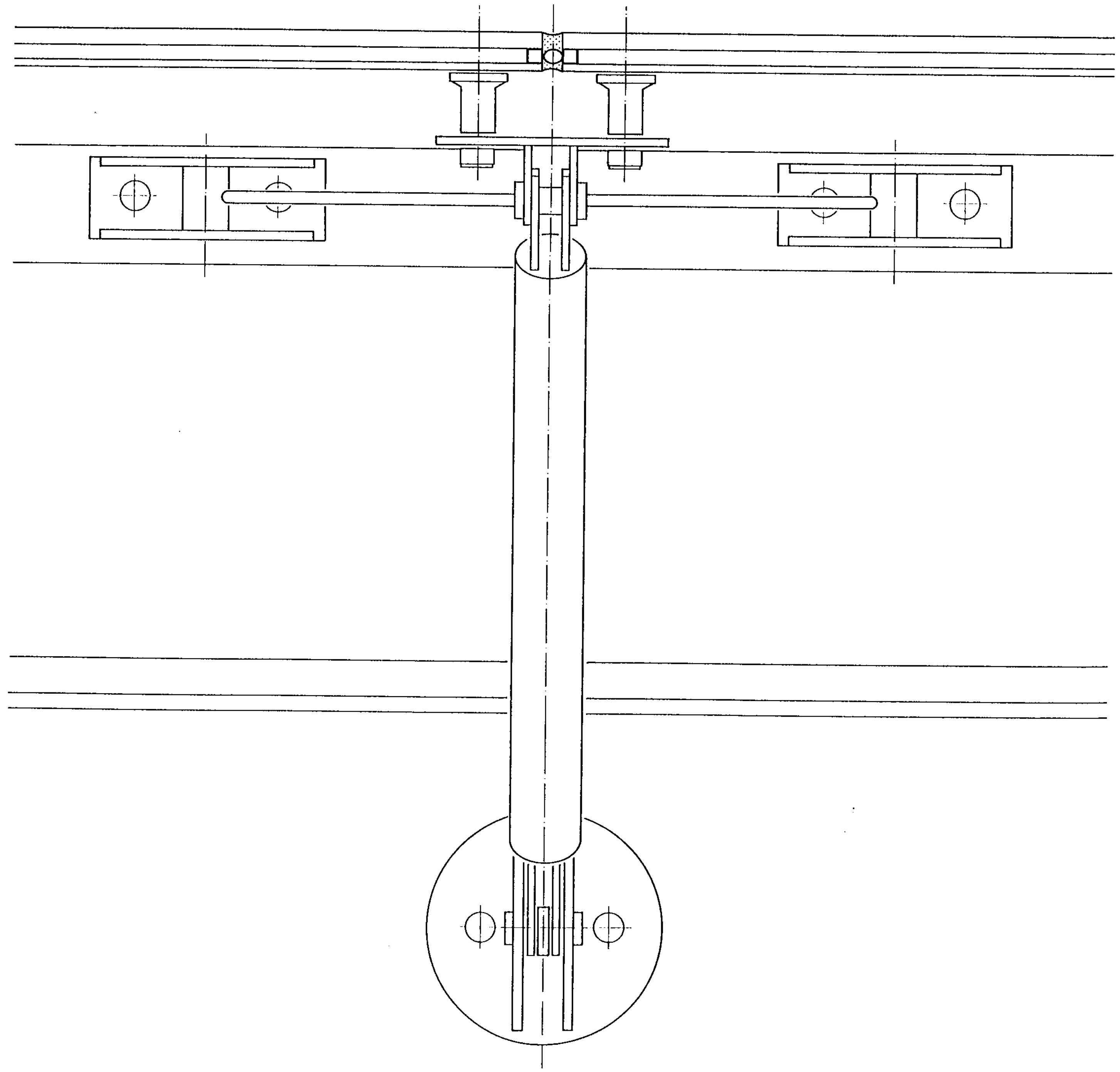
DETAIL

Zeitschrift für Architektur + Baudetail · Review of Architecture
Serie 1991 · **1** · Bauen mit Glas · Glass Constructions



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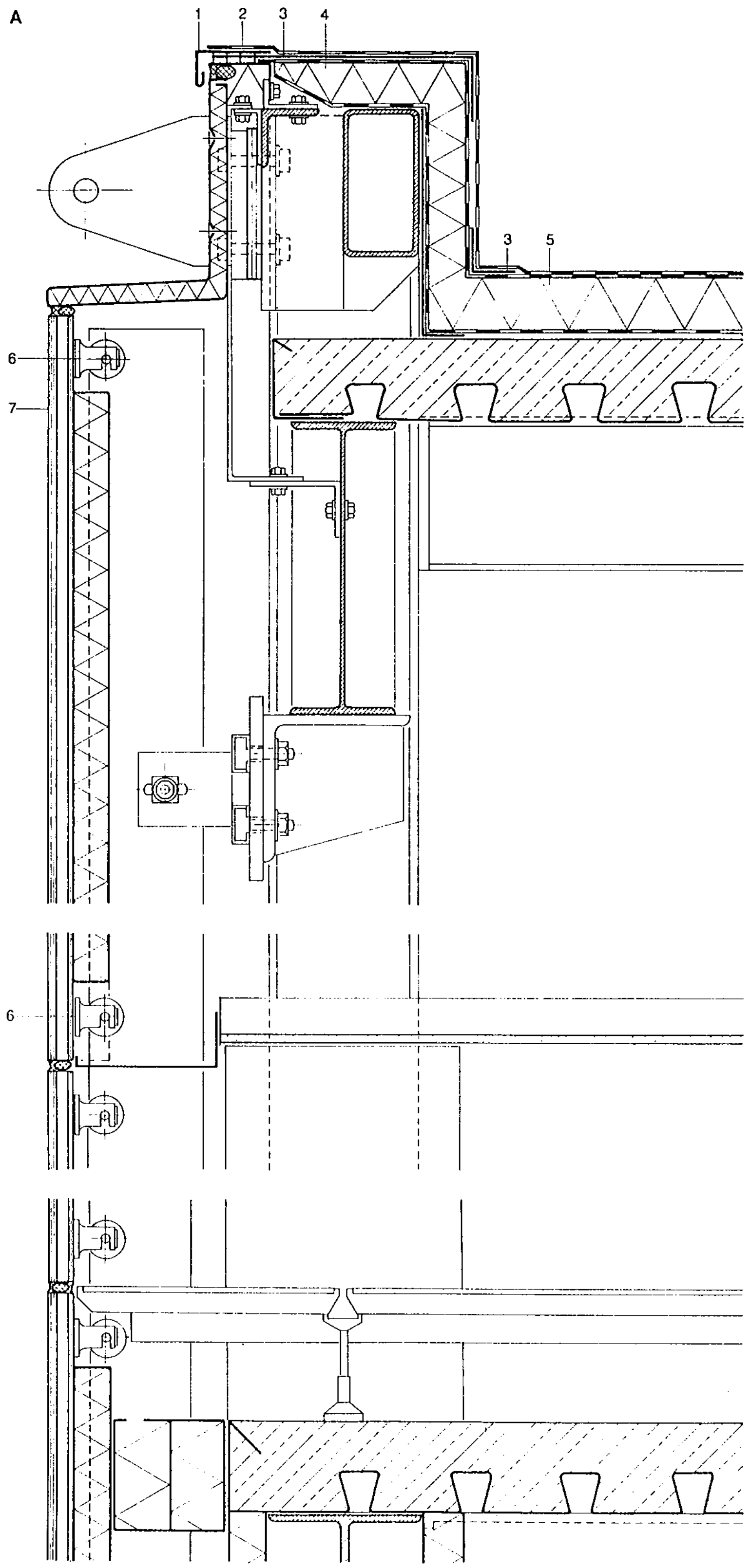

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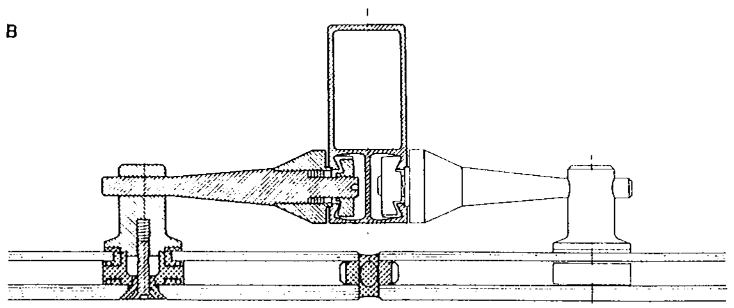

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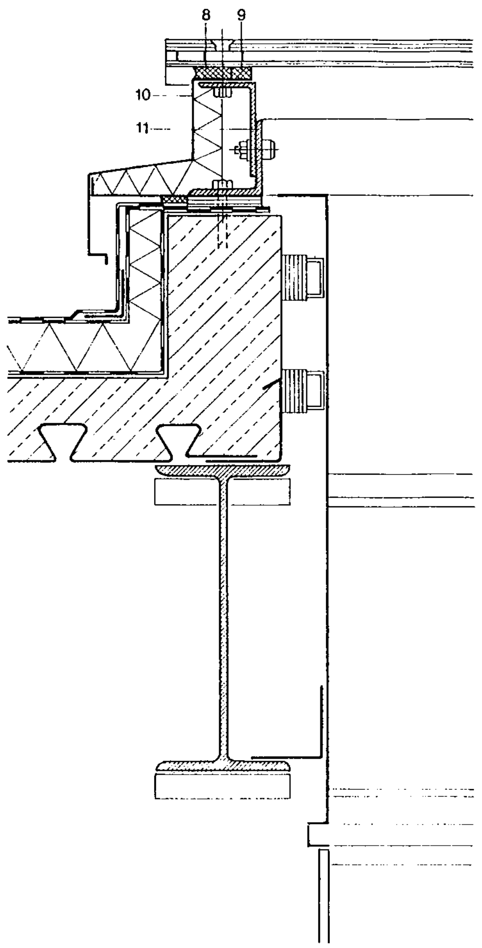

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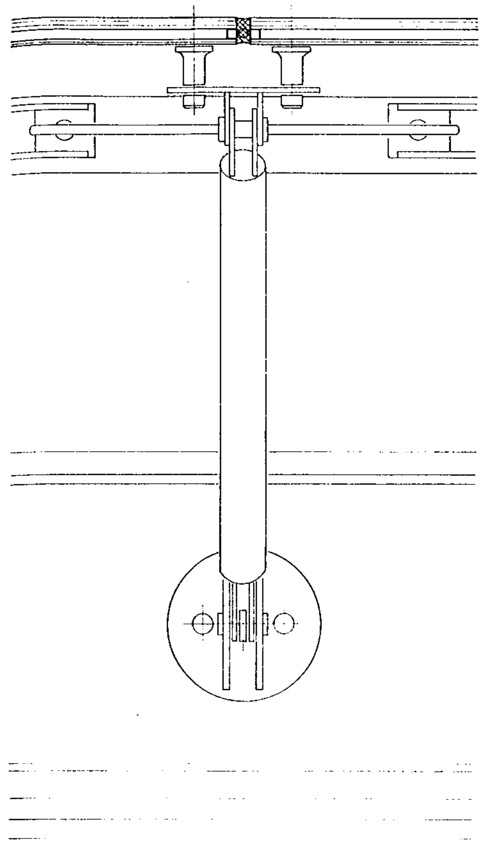

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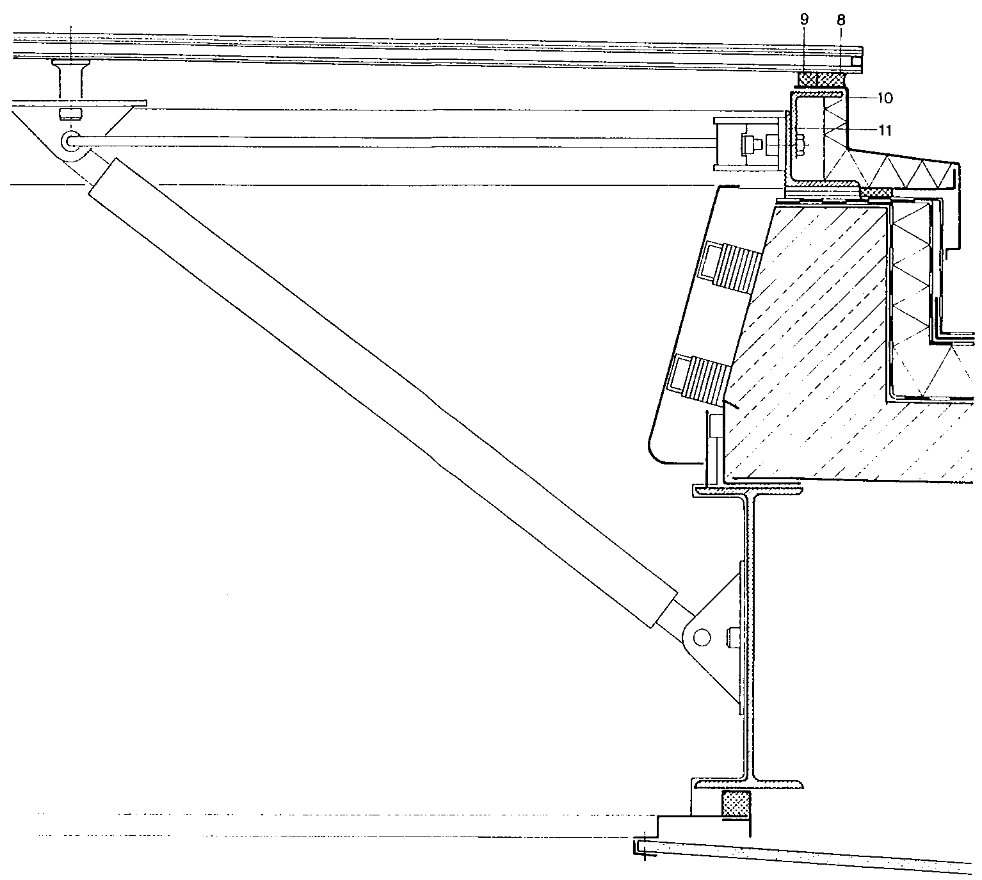


A Vertikalschnitt Dach-Fassade Maßstab 1:10
1 Randausbildung mit gekantetem, weiß beschichteten Stahlblech
2 PVC Dachhaut
3 Stabilisierungsblech
4 Dämmung 50 mm
5 Dampfsperre
6 Paneelaufhängung
7 Glaspaneel

B Horizontalschnitt Maßstab 1:5 Befestigung der Glaspaneele mit Spezialelement Fugenversiegelung mit schwarzem Silikon Verglasung innen 6 mm vorgespanntes Klarglas, 16 mm Luftraum, außen 10 mm Klarglas mit weiß gesinterten Streifen

C Dachanschluß Glasoberlicht im Längsschnitt 1:10
8 Silikonfuge
9 Gummidichtungsprofil
10 Abdeckblech
11 Befestigungswinkel 100/100/8 cm

D Ansicht der Befestigungselemente der Glasoberlichtpaneele Maßstab 1:10

E Dachanschluß Glasoberlicht Querschnitt Maßstab 1:10

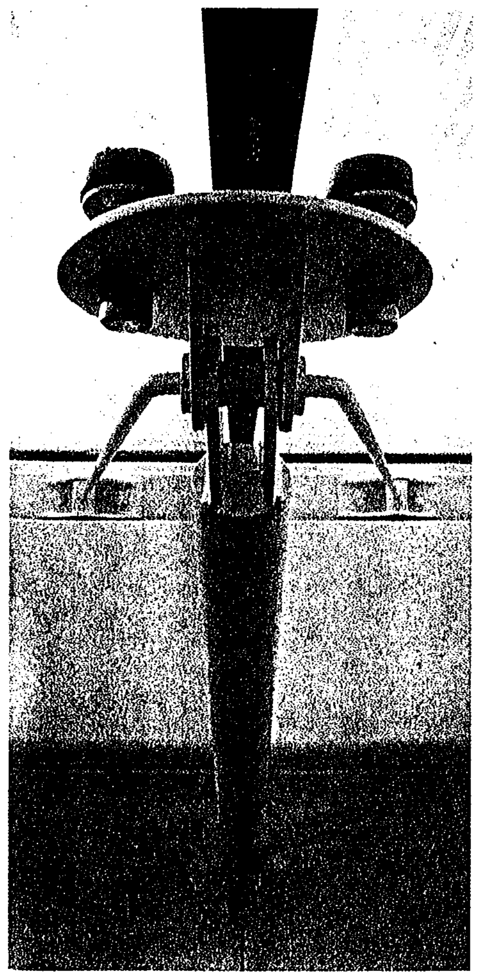
A *Vertical section roof-facade scale 1:10*
1 edge design with steel sheet folded and coated white
2 PVC roofing
3 stabilizing sheet
4 insulation 50 mm
5 vapour barrier
6 panel suspension
7 glass panel

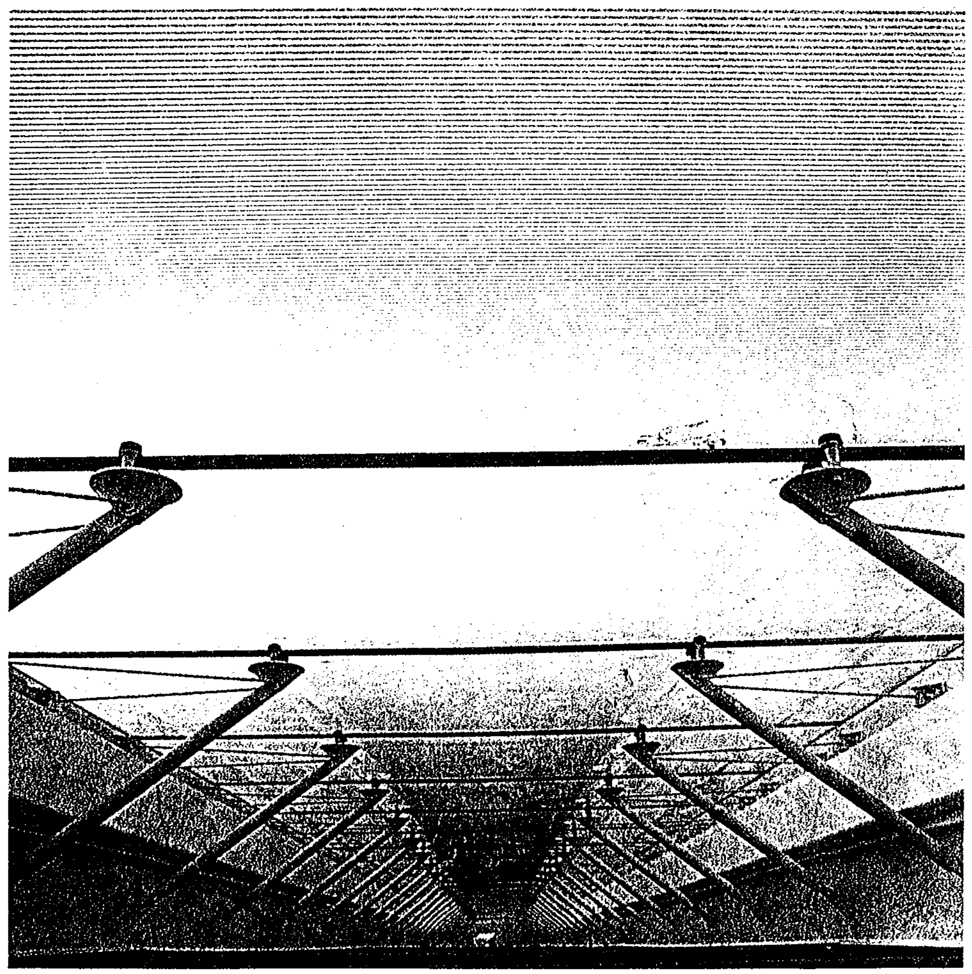
B *Horizontal section scale 1:5 fastening of glass panel with special element joint sealing with black silicone interior glazing 6 mm toughened clear glass 16 mm air space exterior 10 mm clear glass with fritted stripes*

C *Glazed roof light in longitudinal section scale 1:10*
8 silicone joint
9 rubber sealing profile
10 covering plate
11 fixing angle 100/100/8 mm

D *Elevating of fixing elements of roof light glass panels scale 1:10*

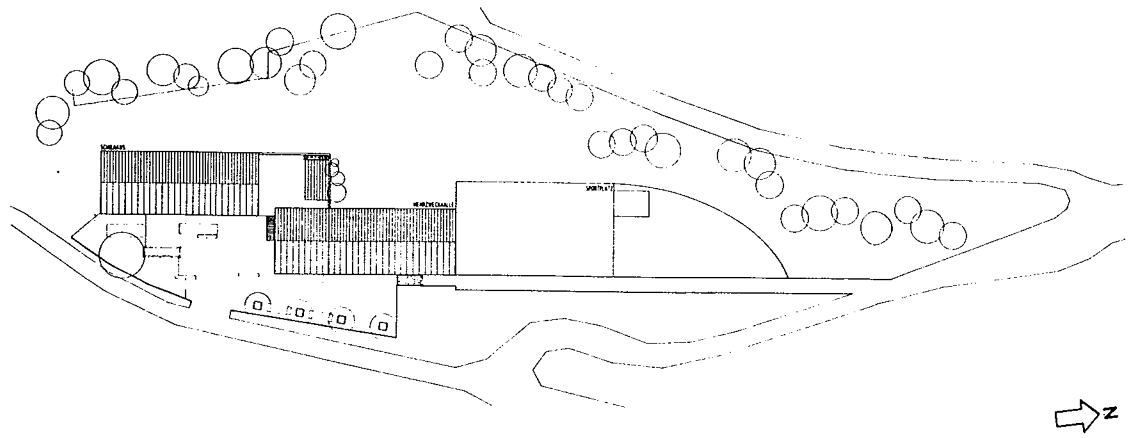
E *Roof connection glazed roof light cross section scale 1:10*





Ansicht von Westen, bei Nacht
■ Vue de l'ouest la nuit
■ View from the west, night view

Situation
■ Site



KONTEXT

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A R C H I T E K T U R A B T E I L U N G E T H
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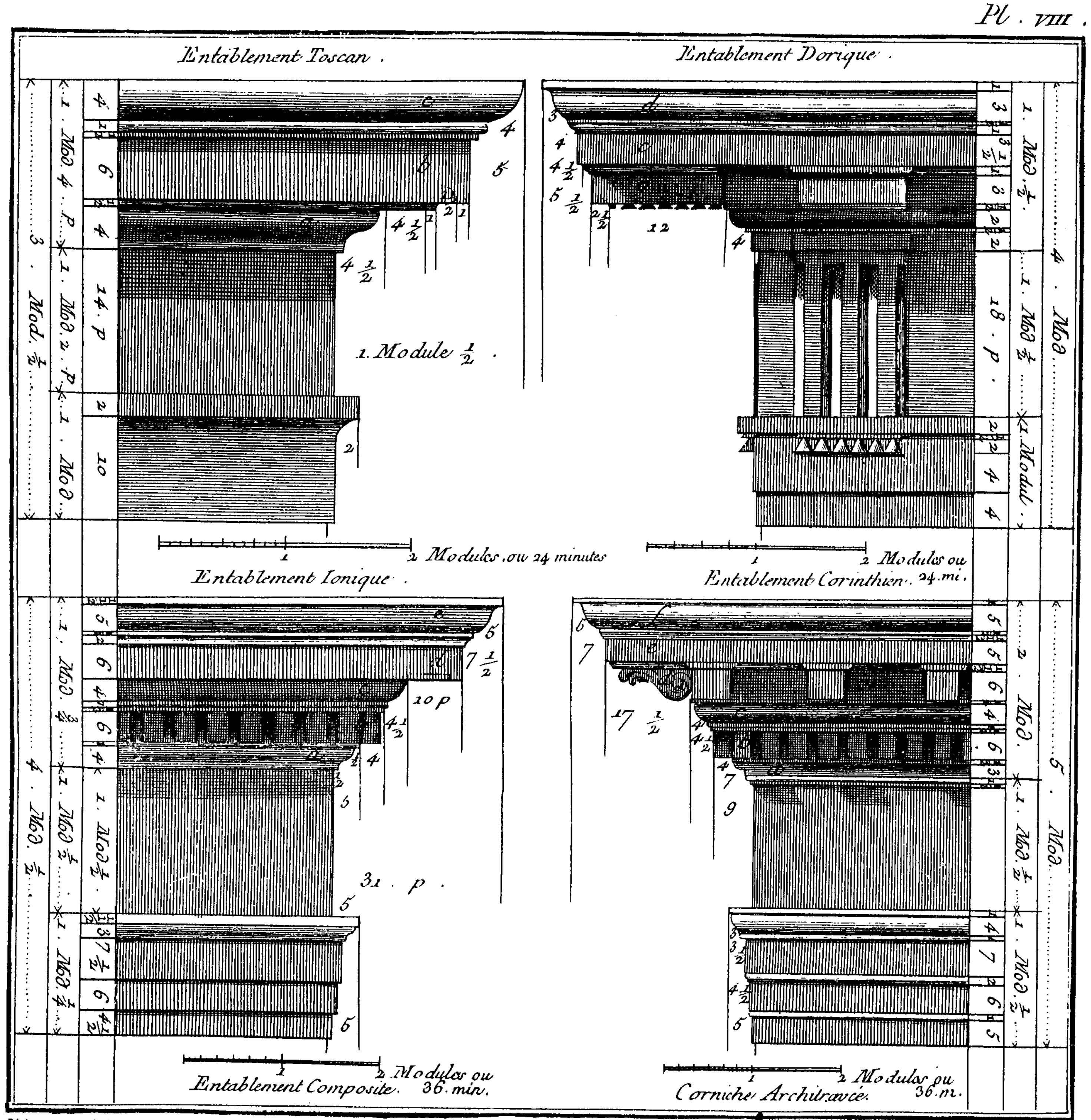

Diderot et d'Alembert: l'Encyclopédie des Sciences, des Arts et des Métiers, Nouv.éd.Genève 1777-79. (Ausschnitt aus einer Tafel) *Benard Fecit*

MATERIAL ZU :

Beschreibung
Descriptif

Bestandteile, Materialien
Die Fussbodenheizung besteht aus CALOFLEX-Heizleitungsrohren aus Spezialkunststoff (Werkstoff PB 4581), Verteilleitungen aus Eisen oder Kupfer, Rohrhalteklemmen, Rohrhalteschienen, Kunststoffverteiler mit diversen automatischen oder manuellen Absperrorganen sowie einer mehrschichtigen CALOFLEX-Integralfolie.

Composants, matériaux
Le chauffage par le sol se compose de conduites tubulaires chauffantes CALOFLEX en matière plastique spéciale (PB 4581), de conduites distributrices en fer ou en cuivre, de colliers et de profilés de fixation, de distributeurs en matière plastique avec divers organes d'arrêt à commande manuelle ou automatique, ainsi que d'une natte intégrale CALOFLEX multicouche.

Konstruktion, Herstellung
Die CALOFLEX-Integralmatte besteht aus vier Schichten: transparente, infrarotdurchlässige Oberflächenschicht aus Kunststoff, reflektierende Mittelschicht aus Aluminium, Grundschicht aus massivem, hochbelastbarem Kunststoff mit luftgefüllten Noppen als Schwingungsdämpfer gegen Trittschall.

Construction, fabrication
La natte intégrale CALOFLEX se compose de quatre couches: une couche superficielle en matière plastique transparente et perméable aux infrarouges, une couche médiane réfléchissante en aluminium, une couche de liaison en aluminium et une couche de base en matière plastique massive de grande capacité de charge, dotée de noppes renfermant de l'air et servant à amortir les vibrations sonores des bruits d'impact.

Abmessungen
CALOFLEX-Heizleitungsrohre:
Innendurchmesser 12 mm, Aussendurchmesser 16 mm
Biegeradius kalt ca. 0,10 m, warm ca. 0,05 m
Rollenlänge 200 m

Dimensions
Conduites tubulaires chauffantes CALOFLEX:
Diamètre intérieur 12 mm, diamètre extérieur 16 mm
Rayon de courbure, froid env. 0,10 m, chaud env. 0,05 m
Longueur des rouleaux 200 m

Eigenschaften
Caractéristiques

Leistungsdaten
Heizleitungsrohre:
Wasserinhalt: 0,113 l/m[1]
Wärmeleitfähigkeit λ: 0,23 W/m K

Données de puissance
Conduites tubulaires chauffantes:
Cubage d'eau: 0,113 l/m[1]
Conductivité thermique λ: 0,23 W/m K

Beständigkeit
Heizleitungsrohre: alterungsbeständig, chemikalienresistent und korrosionsfest
Integralmatte: alterungsbeständig, mechanisch stabil und feuchtigkeitsunempfindlich

Résistance
Conduites tubulaires chauffantes: inaltérables, résistant aux produits chimiques et à la corrosion
Natte intégrale: inaltérable, résistance mécanique élevée et insensible à l'humidité

Projektierung
Etude du projet

Funktionelle Eignung
Einsatzbereich: Fussbodenheizung in Verbindung mit beliebigen Wärmequellen

Aptitude fonctionnelle
Domaine d'utilisation: chauffage par le sol combiné avec n'importe quelle source de chaleur

Entwurfsdetails
Dicke der Wärmedämmschicht: gegen Erdreich und unbeheizte Kellerräume 40 mm, gegen beheizte Räume 20 mm
Zementdecke: Der beigemischte Calofloor-324-Zementzusatz verhindert die Rissbildung und bewirkt eine bessere Wärmeübertragung.
Bodenbeläge: keramische Platten, Parkett, textile und PVC-Bodenbeläge (verlangen Sie die spezielle CALOFLEX-Broschüre über Bodenbeläge).

Détails du projet
Epaisseur de la couche calorifuge: sur sol et locaux en sous-sol non chauffés 40 mm, sur locaux chauffés 20 mm
Aire de ciment: l'adjuvant pour ciment Calofloor 324 ajouté empêche la fissuration et provoque une meilleure transmission de la chaleur.
Revêtements de sols: dalles céramiques, parquet, revêtements textiles et PVC (demandez la brochure CALOFLEX spéciale sur les revêtements de sols).

Baustelle
Chantier

Bauseitige Voraussetzungen
Die Heizanlagen müssen nach Möglichkeit bis zum Verteiler fertig montiert, druckgeprüft und betriebsbereit sein. Besenreine Unterlage.

Conditions à assurer par le commettant
Les installations de chauffage doivent autant que possible être complètement montées jusqu'au distributeur, testées quant à la pression et prêtes à fonctionner. Fond balayé.

Arbeitsvorgang
Auf den rohen Betonboden wird eine Wärmedämmschicht (Polystyrol-Hartschaum PS 20 SE) verlegt und darauf die CALOFLEX-Integralmatte ausgebreitet. Mit Hilfe der Befestigungsklemmen und der CALOFLEX-Spezialkunststoffschienen werden die CALOFLEX-Bodenheizungsrohre auf die Matte verlegt und an den CALOFLEX-Verteiler angeschlossen. Darüber wird eine Zementdecke von ca. 6,5 cm Dicke eingebracht.

Opérations
On pose sur le sol de béton brut une couche calorifuge (mousse dure de polystyrène PS 20 SE), sur laquelle on étend la natte intégrale CALOFLEX. Au moyen des colliers de fixation et des profilés en plastique spéciaux CALOFLEX, on pose les tuyaux du chauffage par le sol CALOFLEX sur la natte et on les raccorde aux distributeurs CALOFLEX. On recouvre ensuite le tout d'une aire de ciment d'env. 6,5 cm d'épaisseur.

Montage
Durch jede fachlich qualifizierte Heizungsfirma.

Montage
Par toute entreprise de chauffage spécialisée.

Betrieb, Unterhalt
Service, entretien

Betriebs-, Kontrollmethoden
Die von den Kunststoffrohren transportierte Wärme wird durch die Aluminiumschicht der Folie reflektiert und als zusätzliche Wärme dem Raum zugeführt. Die Aufheizzeit wird dadurch verkürzt und die Temperaturverteilung an der Oberfläche des Fussbodens verbessert. Die integrierten luftgefüllten Noppen dienen als Schwingungsdämpfer für den Trittschall. Die PE-Trägerfolie wirkt zudem als Feuchtigkeitssperre. Zonenventil mit Zimmerthermostat zur automatischen Nachregulierung exponierter Südräume.

Méthodes d'exploitation et de contrôle
La chaleur transportée par les tuyaux en matière plastique est réfléchie par la couche d'aluminium de la feuille et introduite dans le local en tant que chaleur supplémentaire. Cette méthode abrège le temps d'échauffement et améliore la répartition de la température en surface. Les noppes remplies d'air intégrées servent à amortir les vibrations sonores des bruits d'impact. La feuille de support en PE fait en outre obstacle à l'humidité. Vanne de zone avec thermostat d'ambiance pour le rajustage automatique dans les pièces exposées au sud.

Schutzmassnahmen
In Böden mit CALOFLEX-Heizung darf weder gespitzt noch gebohrt werden. Vor Übergabe der Anlagen müssen die detaillierten Abnahmeprotokolle ausgefüllt werden.

Mesures de protection
Il ne faut ni piquer ni percer dans les sols dotés d'un chauffage CALOFLEX. Les procès-verbaux de réception détaillés doivent être remplis avant la remise des installations.

Kommerzielle Daten
Données commerciales

Preise, Garantie
Preise: auf Anfrage
Garantie: 10 Jahre für Folgeschäden wie Schäden durch Aufspritzen usw. Deckung durch eine Schweizer Versicherung.

Prix, garantie
Prix: sur demande
Garantie: 10 ans pour les dégâts consécutifs à des travaux tels que repiquage, etc. Couverture par une compagnie d'assurances suisse.

Firmeninformation
Informations générales

Beratungsdienst
Eigener EDV-Berechnungsdienst. Spezial-CALOFLEX-Integral-Fussbodenheizungsprogramme für HP 97, HP 41 CV, Commodore- und Plancalcomputer, MS DOS

Service-conseil
Service de calcul TEI. Programmes de chauffage par le sol intégral CALOFLEX spéciaux pour le HP 97, HP 41 CV, Commodore et Plancal, MS DOS

CALOFLEX®

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Energiesysteme
Grossrietstrasse
8606 Nänikon
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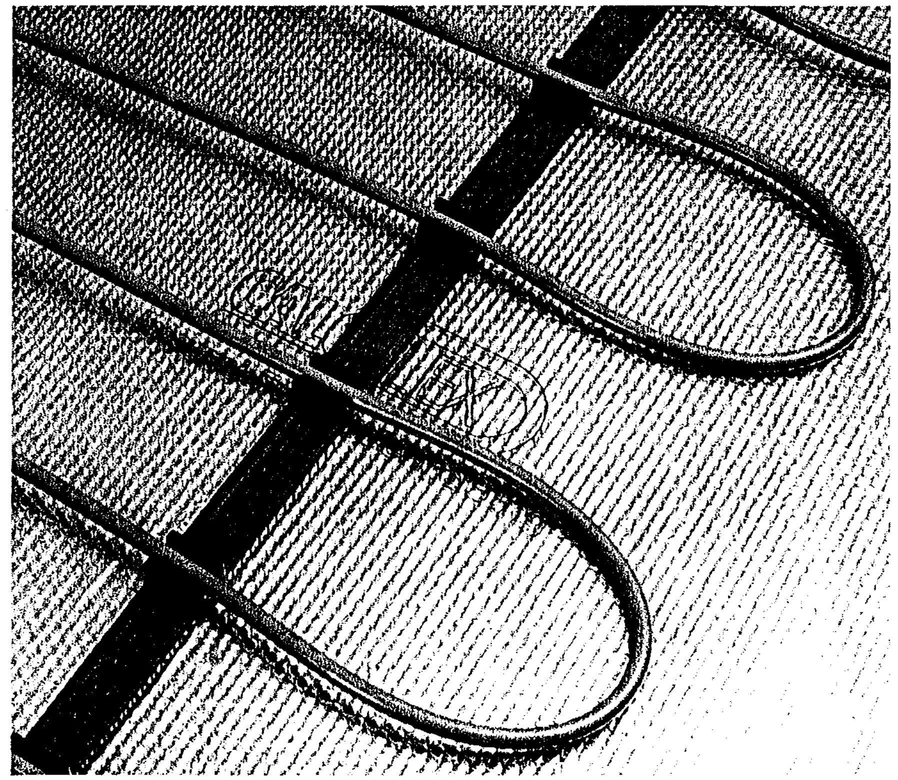
Fax 01 / 905 56 60

CALOFLEX-Integral-Fussbodenheizung
Chauffage par le sol intégral CALOFLEX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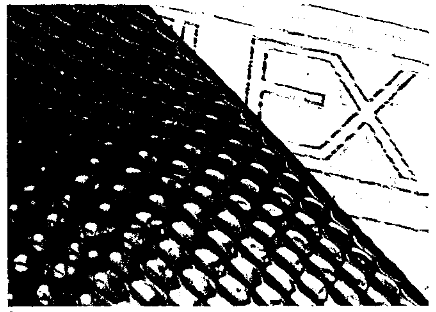
Kurzbeschreibung
Die CALOFLEX-Integral-Fussbodenheizung wird in den Unterlagsboden eingelegt und ist aus Heizleitungsrohren aus Spezialkunststoff (PB 4581) sauerstoffdicht sowie aus einer mehrschichtigen Integralmatte aufgebaut. Die Wärmequellen können Heizkessel, Fernwärme, Sonnenkollektoren, Elektrospeicher oder Wärmepumpen sein. Durch die wärmereflektierende Aluminiumschicht in Verbindung mit einer Luftschicht in der Integralmatte verteilt sich die Temperatur an der Oberfläche des Fussbodens gleichmässiger und schneller. Der reduzierte Wärmeverlust nach unten wirkt sich positiv auf den Energieverbrauch aus. Integrierte Trittschalldämmung nach SIA 181 und DIN 4109 für erhöhte Ansprüche (Eigentumswohnungen).

Descriptif succinct
Le chauffage par le sol intégral CALOFLEX se loge dans le sous-plancher et il se compose de conduites tubulaires chauffantes faites d'une matière plastique spéciale (PB 4581) étanche à l'oxygène ainsi que d'une natte intégrale multicouche. La chaleur peut provenir d'une chaudière, d'un chauffage à distance, de collecteurs solaires, d'accumulateurs électriques ou de pompes thermiques. Grâce à la couche d'aluminium réfléchissant la chaleur, combinée avec une couche d'air dans la natte intégrale, la température se répartit plus régulièrement et plus rapidement à la surface du sol. La réduction de la déperdition de chaleur vers le bas se répercute positivement sur la consommation d'énergie.
Pour hautes exigences (appartement en propriété), isolation des bruits d'impact intégrée selon DIN 4109.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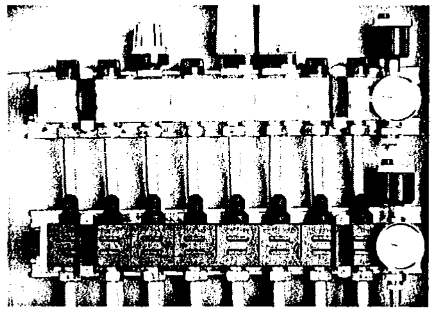
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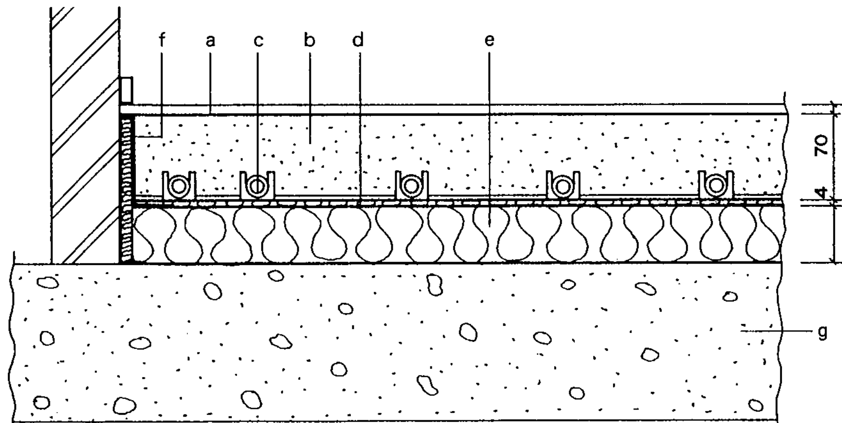

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Legende
a Bodenbelag
b Unterlagsboden
c CALOFLEX-Heizrohr mit Klemme (sauerstoffdicht)
d CALOFLEX-Integralmatte
e Wärmedämmschicht (Polystyrol PS 20 SE)
f Randstreifen
g Beton

Légende
a Revêtement de sol
b Chape
c Tubes chauffants avec clips (étanche à l'oxygène)
d Natte intégrale CALOFLEX
e Couche thermo-isolante (polystyrène PS 20 SE)
f Isolation de bordure
g Béton

Abbildungen
1 Verlegte CALOFLEX-Integral-Bodenheizung
2 CALOFLEX-Integralmatte
3 CALOFLEX-Verteiler
4 Aufbau, Konstruktion

Illustrations
1 Chauffage par le sol intégral CALOFLEX en place
2 Natte intégrale CALOFLEX
3 Collecteur CALOFLEX
4 Construction

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DETAIL

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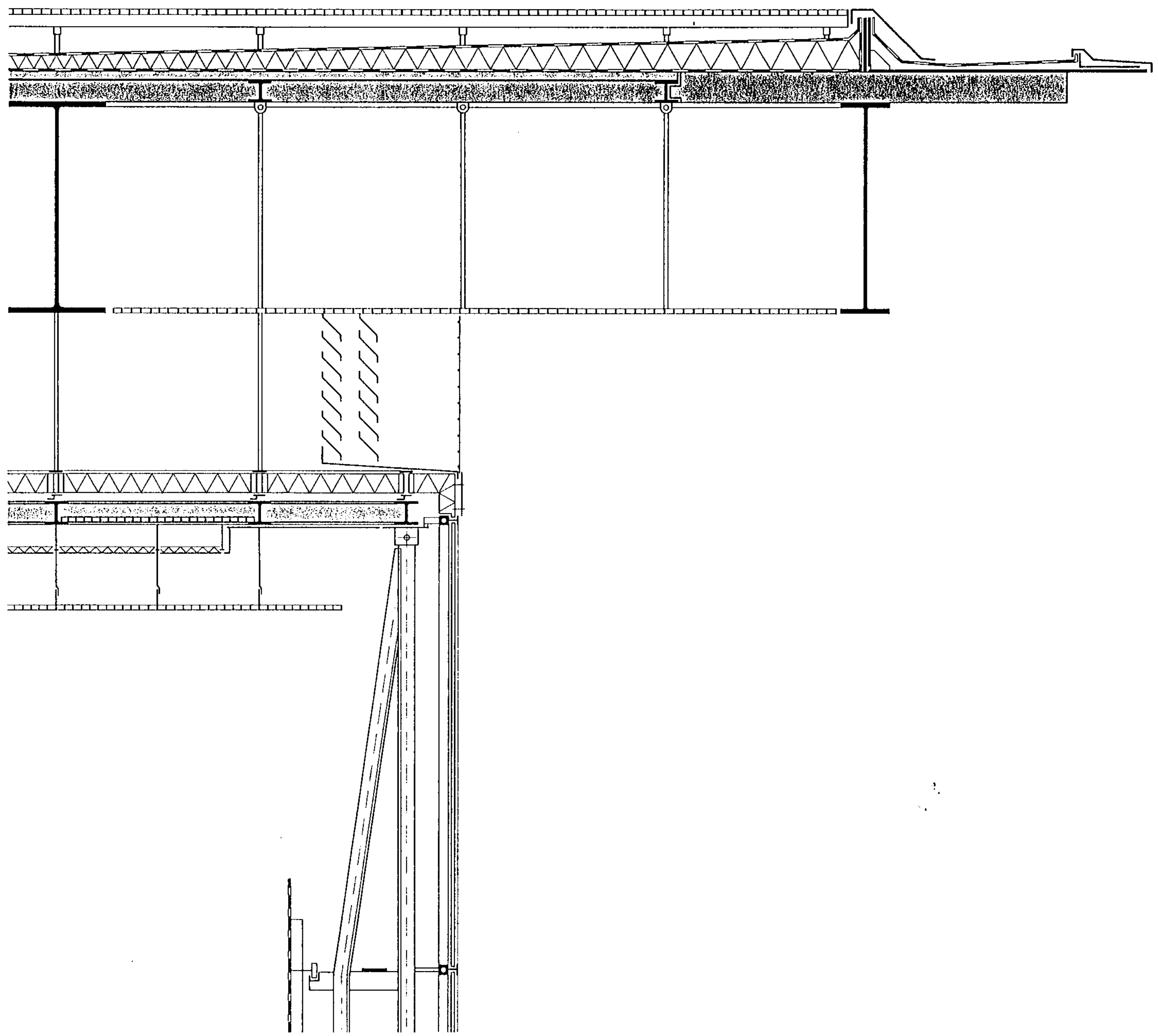
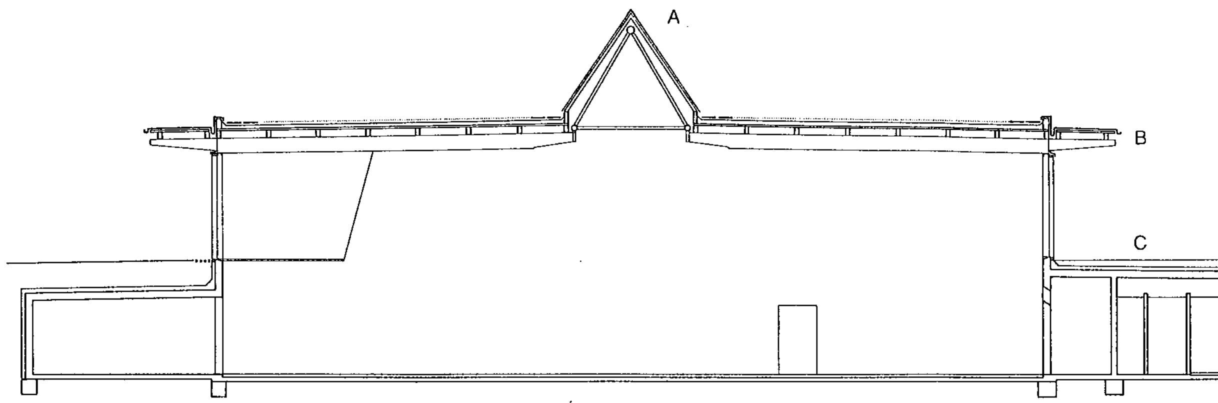
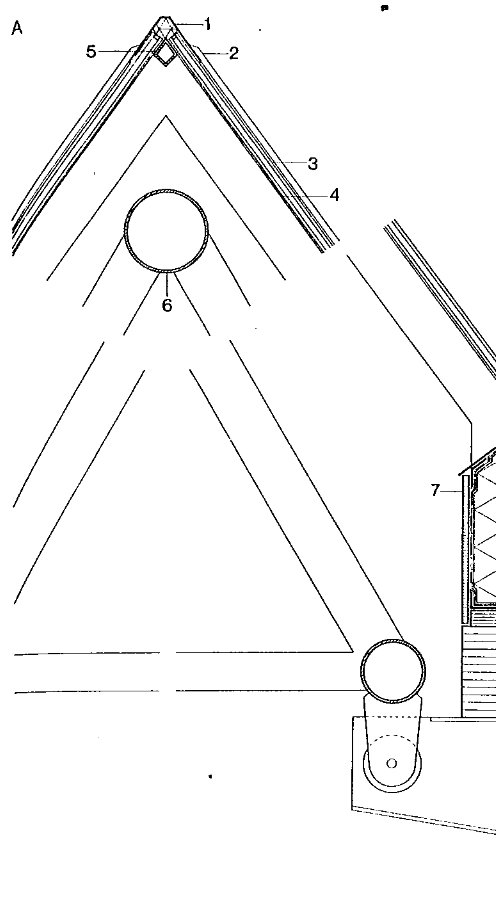




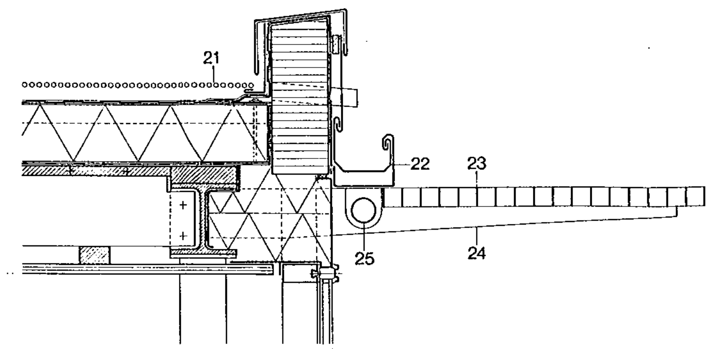
Schnitt aa Maßstab 1:250

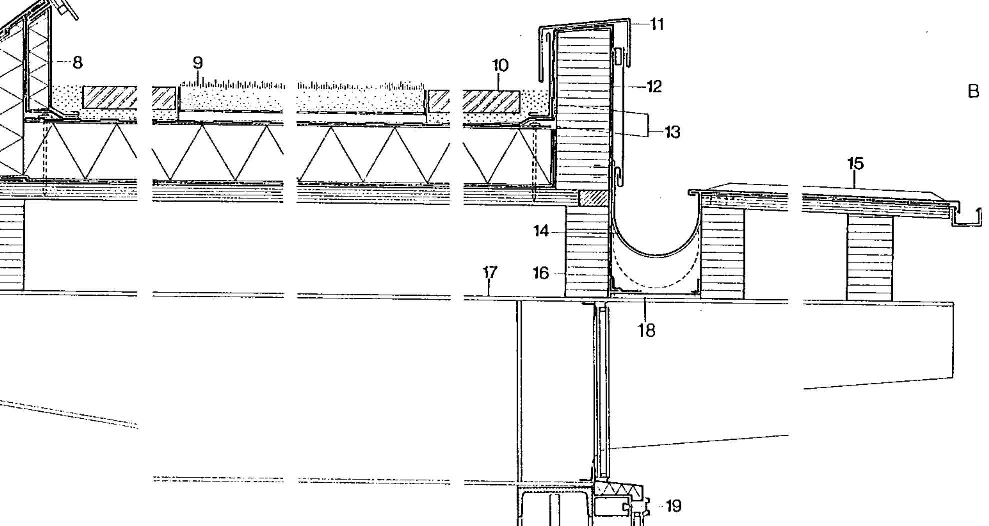
Section aa scale 1:250

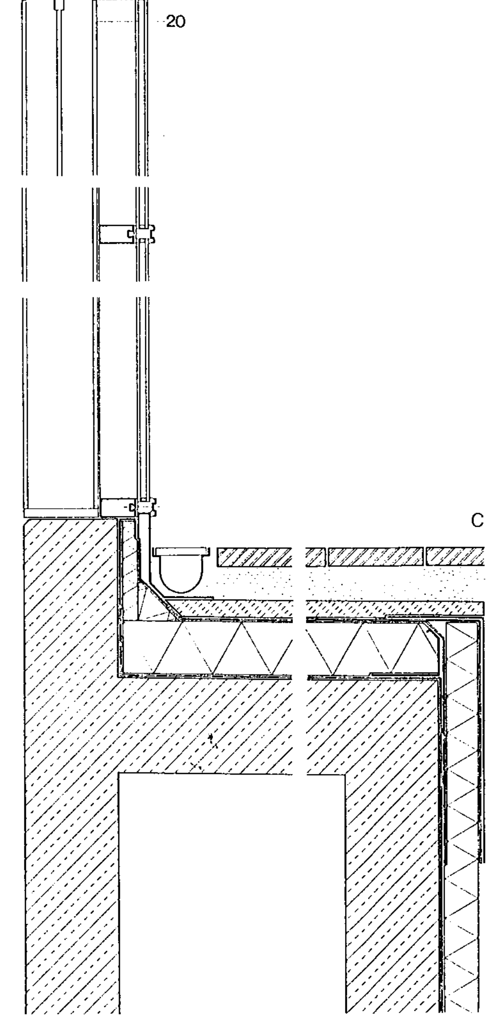


Detail Dachrand
Eingangspavillon
Maßstab 1:20

Detail
entrance pavilion roof/canopy
scale 1:20





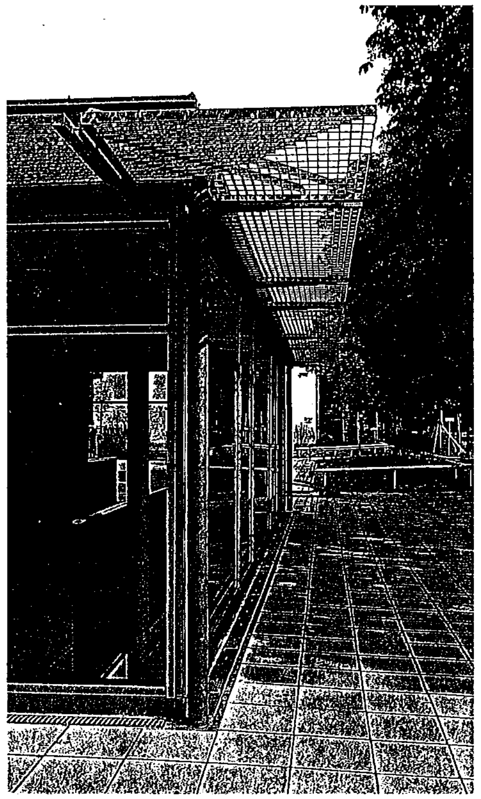


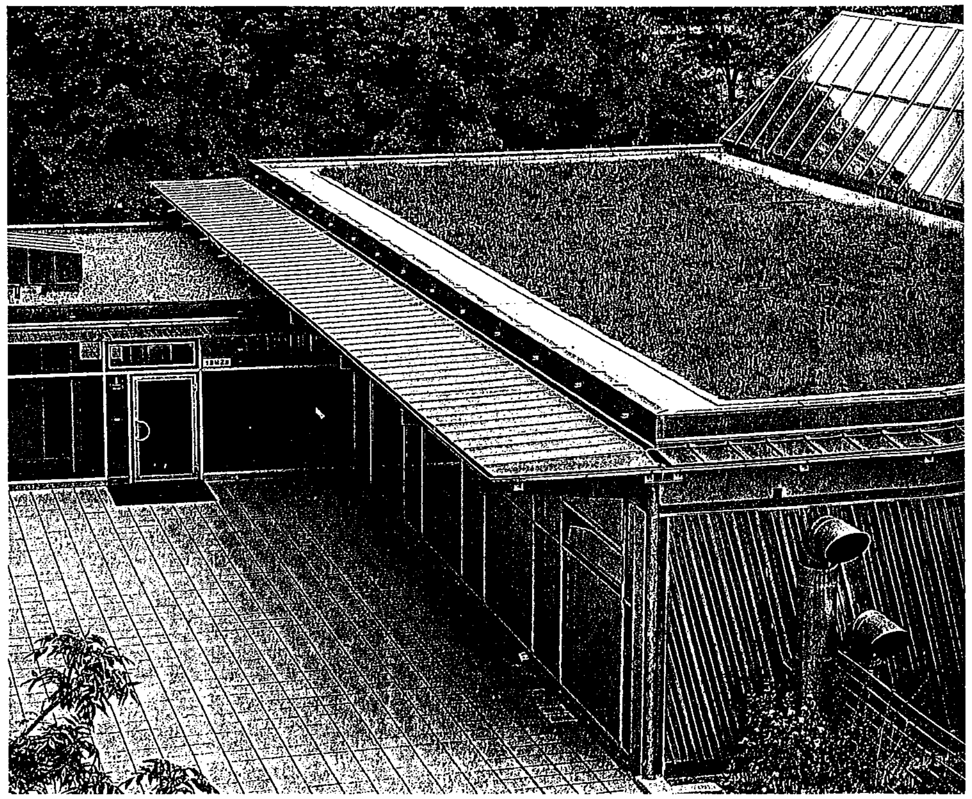
1 Alu-Firstblech 2 mm
2 Alu-Preßleiste 1 mm
3 Isolierverglasung:
obere Scheibe VSG 8,
untere Scheibe ESG 8
4 Stahlrohr 120/50/4 mm verschweißt
5 Firstprofil aus verzinktem Stahl 3 mm
6 Stahlrohr Ø 219 mm
7 Industriesperrholz, wasserfest verleimt
8 Titanzinkblech
9 Dachaufbau extensive Begrünung:
Vegetationsmatte 10 mm
Substratschicht 60 mm
Filtervlies
Drainmatte 20 mm
Filz 500 g/m²
glasvliesverstärkte Kunststoff-
abdichtung (G471/24)
10 Dachaufbau:
Gehwegplatten 60/40/5 mm
Kiesbett
Filz 500 g/m²
glasvliesverstärkte Kunststoff-
abdichtung (G471/24)
druckfeste Wärmedämmung 150 mm
Dampfsperre V13
Holzschalung 40 mm
11 Titanzinkblech 0,7 mm
12 Brettschichtholz 150/420 mm
13 Wasserspeier kunststoffkaschiert
100/60/250 mm
14 Titanzinkblechrinne, beheizt
15 Vordachaufbau:
Titanzinkblech 0,7 mm mit Stehfalz,
5% Gefälle
Trennlage
Sperrholz, wasserfest verleimt
30 mm
16 Brettschichtträger 120/240 mm
17 IPE 500
18 Alublech mit Raupenprägung
19 Stahlrohr 100/50/3,6 mm
20 IPB 200
21 Dachaufbau Pavillon:
Kiesschüttung 60 mm
Polyestervlies
PVC-Folie 2,4 mm
Wärmedämmung 150 mm
Dampfsperre
Holzschalung
Brettschichtholzträger
120/180 – 270 mm
22 Titanzinkblechrinne
23 Stahlrost verzinkt
24 Flachstahl 10 mm
25 Leuchte

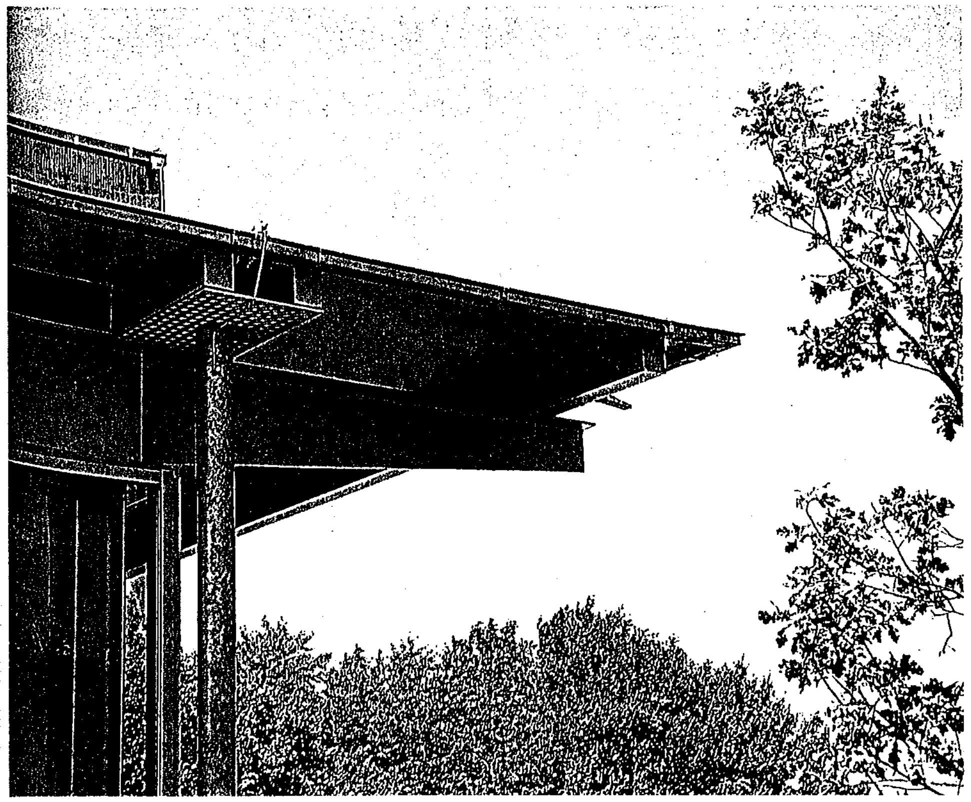
1 2 mm aluminium ridge capping
2 1 mm compressed aluminium strip
3 double glazing: outer sheet: 8 mm laminated safety glass
inner sheet: 8 mm safety glass
4 120/50/4 mm rectangular section welded steel tube
5 3 mm galvanized steel ridge section
6 steel tube, 219 mm dia.
7 weatherproof, industrial quality plywood
8 titanium-zinc sheet
9 roof construction with planting:
10 mm vegetation mat
60 mm substratum
filter mat
20 mm drainage layer
felt (500 gr/m²)
glass-fibre-reinforced plastic seal
10 roof construction:
60/40/5 mm paving slabs
gravel bed
felt (500 gr/m²)
glass-fibre-reinforced plastic seal
150 mm compression-resistant thermal insulation
waterproof membrane
40 mm timber boarding
11 0.7 mm titanium-zinc sheet capping
12 150/420 mm laminated timber kerb
13 100/60/250 mm plastic-coated water spout
14 titanium-zinc heated rainwater gutter
15 canopy construction:
0.7 mm titanium-zinc sheet with standing seams; 5% falls
separating layer
30 mm waterproof plywood
16 120/240 mm laminated timber beam
17 I-beam 500 mm deep
18 aluminium sheeting with beaded surface
19 100/50/3.6 mm rectangular section steel tube
20 I-beam 200 mm deep
21 pavilion roof construction:
60 mm gravel filling
polyester mat
2.4 mm PVC sheeting
150 mm thermal insulation
moisture-proof barrier
timber boarding
120/180 – 270 mm laminated timber beam
22 titanium-zinc rainwater gutter
23 galvanized steel grating
24 10 mm steel flat
25 light fitting

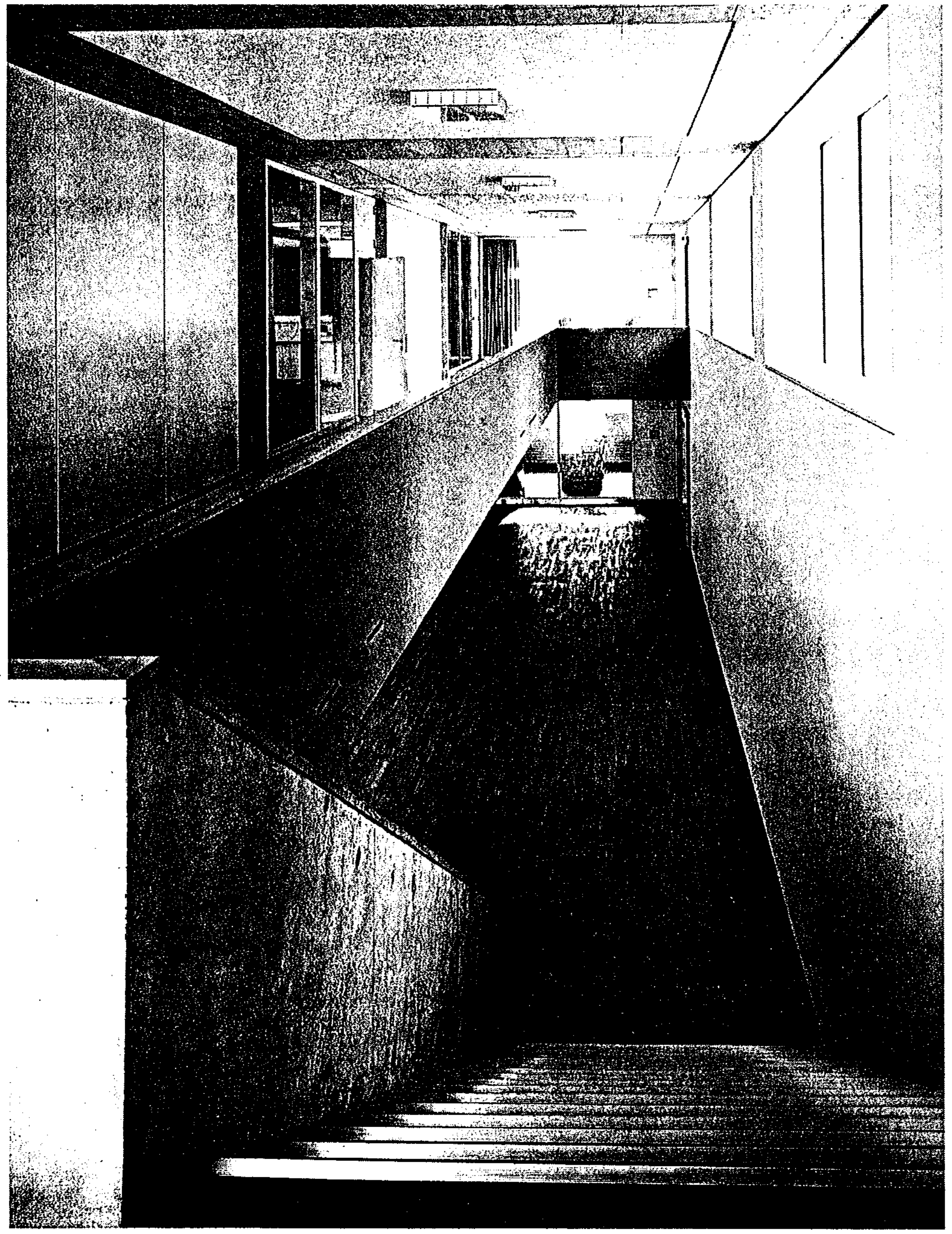
Dachdetails Maßstab 1:20

Roof details scale 1:20





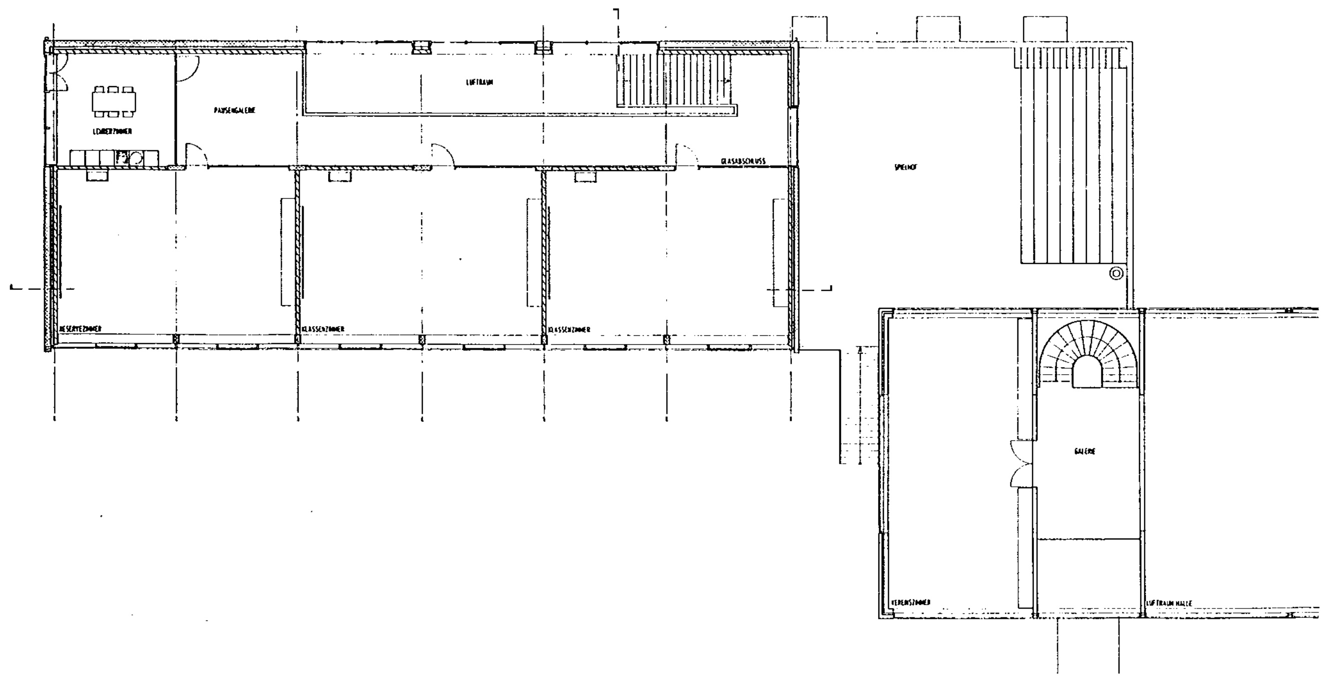




Zweigeschossiger innerer Pausenraum
■ Hall de récréation à deux niveaux
■ Two-storey interior playroom

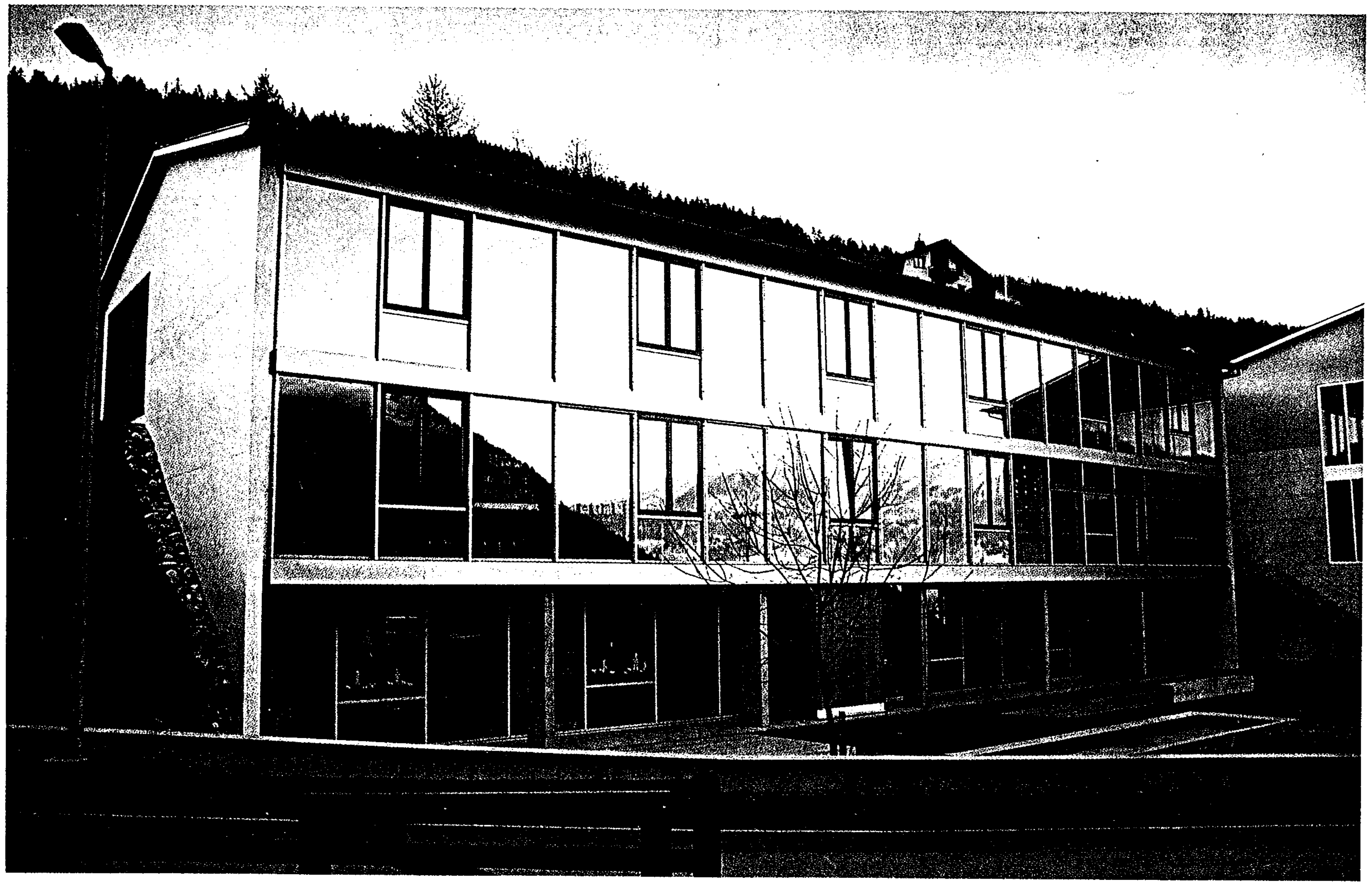
Klassenzimmer
■ Salle de classe
■ Classroom

2. Obergeschoss
■ 2ème étage
■ 2nd floor



Schulhaus in Malix, 1994

Architekten: Valentin Bearth, Andrea Deplazes, Chur



Ansicht von Westen, bei Tag

■ Vue de l'ouest le jour

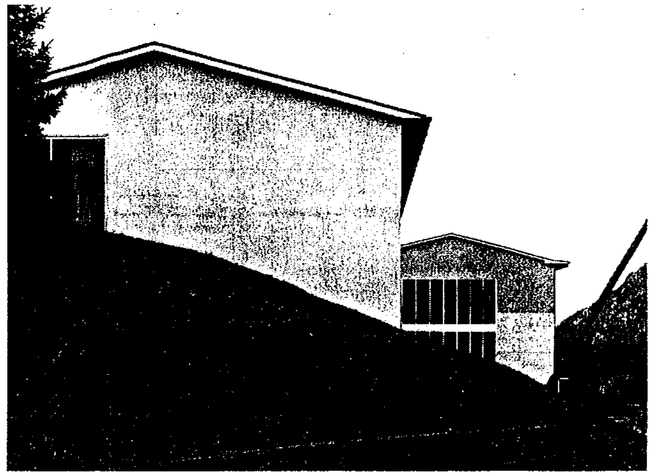
■ View from the west, daytime

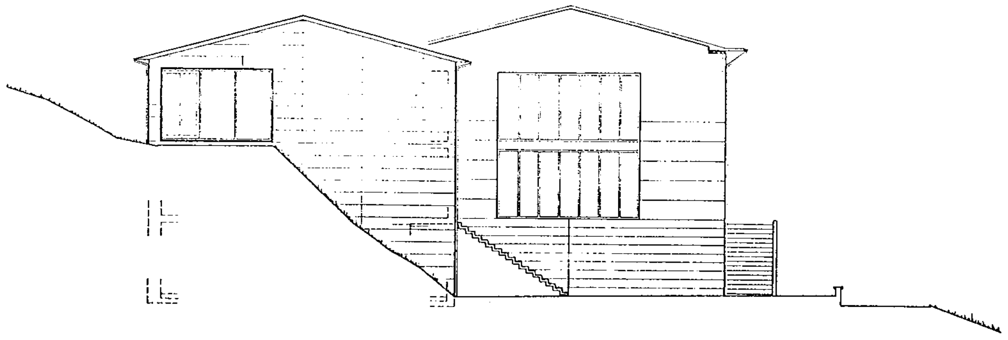
Das dreigeschossige Primarschulhaus steht an einem leicht abfallenden Hang. Vor rund zehn Jahren wurde auf dem Schulgelände eine Mehrzweckhalle erstellt (Architekt: Peter Zumthor), die in die Disposition der Neubauten einbezogen wurde. Das Schulhaus ist volumetrisch dem Mehrzweckgebäude angeglichen und parallel zum alten Gebäude, hangaufwärts, verschoben. So entsteht – ohne baulichen Aufwand und architektonisches Beiwerk – ein Schulhof. Genauer: ein Schulhof in den Bergen. Er ist nur fragmentarisch ausgebildet, seine räumlichen Begrenzungen sind bloss angedeutet, so dass der Eindruck von einem ambivalenten Ort entsteht, den weder die Geschlossenheit eines Hofes noch die Offenheit eines Platzes kennzeichnet.

Das Konzept einer aufgelockerten Besiedlung entspricht einem spezifischen Verhältnis von Architektur und Landschaft. Es spiegelt eine Theorie der Klassik (der griechischen Antike), wonach Architektur Natur nicht nachahmt, sondern antizipiert. In diesem Fall folgt der bauliche Eingriff der Vorstellung einer fliessenden Landschaft, was besonders die Leichtigkeit des kompakten Baukörpers untermalt.

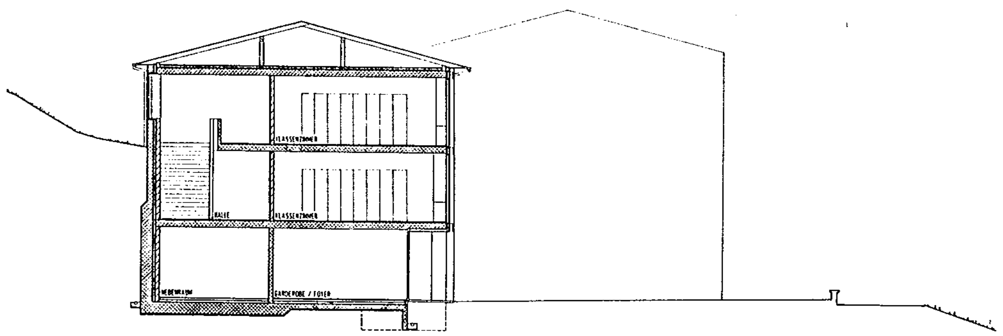
Gewissermassen als innenräumliche Analogie ist das Schulhaus durchlässig konzipiert. Lichtführung und Transparenz werden doppelseitig in Szene gesetzt: von aussen nach innen und vom geschlossenen zweigeschossigen Pausenraum zu den Klassenzimmern.

Die gläserne Fassade erreicht einen k-Wert von 0.75 (Glas: 0.66), so dass auf Konvektoren verzichtet werden konnte. Kombiniert mit einer Tageslichtsteuerung wird ein hoher Energiespareffekt erwartet. *Red.*

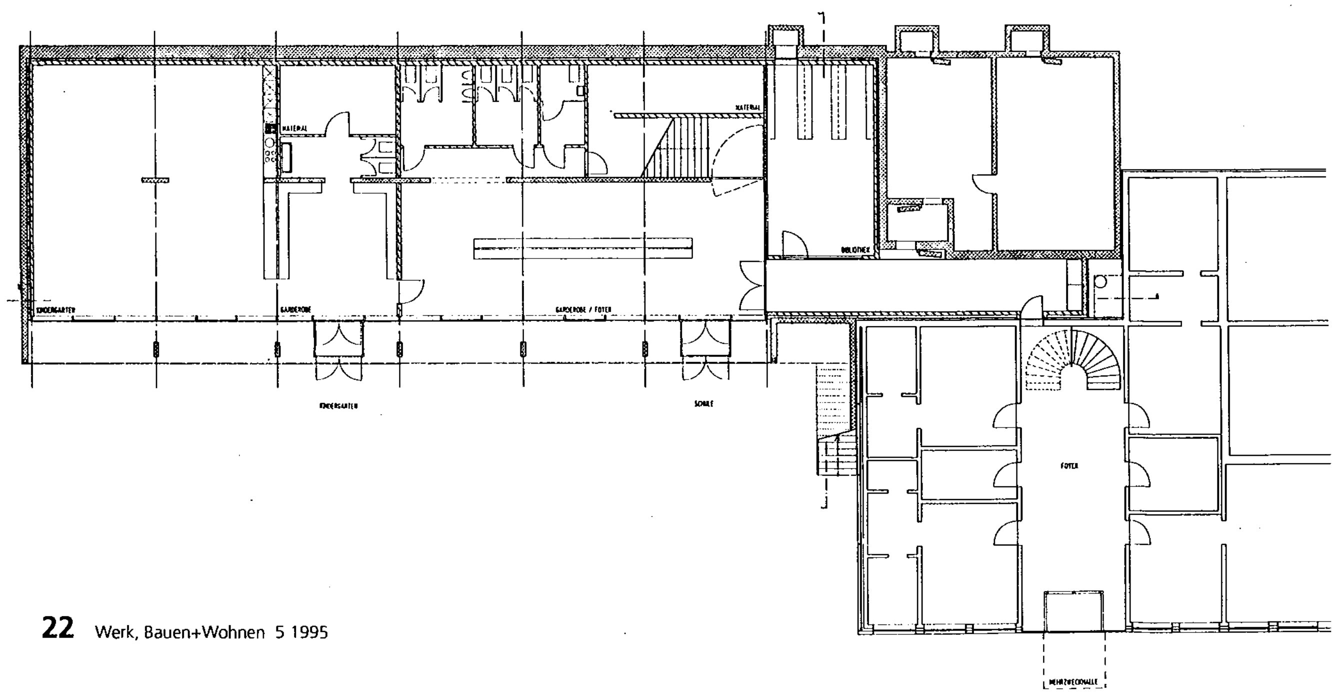




Ansicht von Norden
■ Vue du nord
■ View from the north



Querschnitt
■ Coupe transversale
■ Cross-section



Erdgeschoss
■ Rez-de-chaussée
■ Ground-floor