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MODERN STEEL CONSTRUCTION

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CONTENTS

EDITORIAL

In January, the American Institute of Steel Construction announced two new classes of membership. Associate membership is for firms supplying equipment and services to the fabricating industry and for manufacturers of allied building products. Professional membership is for architects and engineers either in practice or teaching. Purpose of this expansion is to provide an opportunity for those interested in the structural steel industry to participate in new developments, and for the design professions to be brought into closer touch with steel fabricators.

As one of the first steps, a session at the National Engineering Conference will be devoted to a discussion of the new professional membership program. Architects and engineers are welcome to attend the Conference to be held at the Mayo Hotel, Tulsa, Okla., April 25-26.

This session will offer an opportunity for exploring ways that architects and engineers can work more closely with AISC and its members. It is a truism that what one gets out of an organization is in proportion to what he puts in. In this day of rapid advances in building technology it is not amiss to present such a challenge for mutual benefit.

Inquiries on both membership and the Conference program may be addressed to Samuel H. Clark, Chief Engineer, at AISC in New York City.

Architectural Firm for Abilene Elementary School, described on pages 8 — 10, MODERN STEEL CONSTRUCTION, 1st Quarter, 1963:

Tittle & Luther, Abilene, Texas

STEEL ARCHES COUNTERPOINT MASSIVE STONE

A liberal use of stone and steel suggests – and guarantees – the stability of Saint Christopher's Church in Columbus, Ohio. The massive, traditional feeling of stone, so desirable for an air of permanence in a church, needed a counterpoint of delicate tracery provided economically only by steel. Large steel bents, or arches, comprised the basis of design and decoration. As opposed to wood, these steel arches became both light and lofty, a feeling emphasized by the nature of the structural shape and the resulting shadow lines.

By repetition of the steel arches on a close module in the sanctuary area, the importance of the altar increased without massiveness. Attention is thus drawn to the altar by multiplying the number of arches that span the sanctuary and by progressively narrowing the walls of the church. Windows placed at the sides of the altar concentrate natural light on it and on the back wall to form the apse of the church.

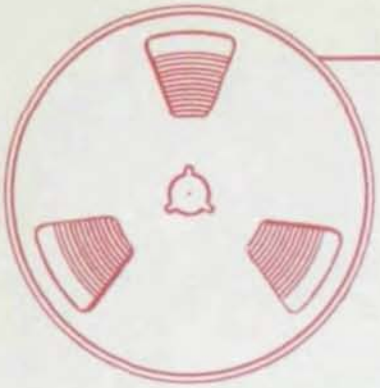
In further design concept, steel provided an opportunity for color to compliment both the structure and the limestone masses. To have based construction on other than steel framing would have required special finishes, heavier members, and would have greatly restricted the use of "floating" canopies over the entries and the structure of the baptistry window in the front facade (which is basically a vertical steel truss faced with aluminum).

The furnishings, although of aluminum and bronze, are designed to reflect the same lines and aesthetics of the arches.

On the practical side, steel was easily obtained and locally fabricated with good control of quality and finish. In comparing costs of wood versus steel (based on bids by two steel companies and three wood companies), steel could be supplied in less time and at less cost, not including the additional shipping charges of wood from the West. Steel offered the opportunity to solve both the aesthetic and the cost problems because of its adaptable nature.

Architects were Emerick, Albert and McGee; structural engineer, Milton E. Miller; general contractor, Trapp Construction Company; and The J. T. Edwards Company fabricated the structural steel. All are Columbus firms.

The nave seats 700 people and provides an unobstructed view of the sanctuary and apse. Windows placed at both sides of the altar concentrate natural light on it.



USING THE ELECTRIC

By Donald R. Goodkind,
Goodkind & O'Dea,
Consulting Engineers,
Montclair, N. J.

The electronic computer has found many fascinating applications in analyzing complex problems in the field of engineering. However, it is important to appreciate that the computer can also be used to solve a host of ordinary but repetitious problems with economy, speed and accuracy. Its employment in providing information for the detailing of structural steel is an example of such a practical, if unglamorous, application.

A good detailing shop has many excellent technicians whose time is much better spent at the drafting board than at the slide rule or desk calculator. Therefore, the time consumed in making these calculations by ordinary means may delay the placing of mill orders and the profitable use of the detailing staff. The electronic computer has proven an ideal instrument to relieve these difficulties.

A project which the Computer Division of Hamden Testing Services, Inc., Montclair, New Jersey, recently completed for Standard Structural Steel Co., of Newington, Connecticut, illustrates a practical application for detailing the structural steel for a modern expressway viaduct.

Such detailing must be preceded by extensive geometric computations. The contract drawings generally present the basic information for a bridge from which the necessary additional dimensions for specific details may be derived. However, since these bridges are often fitted into roadway systems which involve the meshing of main lines and ramps on curved alignments and the variable warping of the road surface to permit high speed travel, the computation step from basic information to specific lengths and elevations may require prolonged manipulation of figures.

Plate I shows the alignment and profile data given on the contract plans for the viaduct carrying the westbound lanes of Interstate Route 84 through a section in Hartford, Conn. At each end of this section local ramps join the main line on independent profiles. Obviously in the regions where these elements combine on the viaduct, the calculation of horizontal and vertical dimensions is especially complicated.

Plates II and III present the layout of structural elements of Span 1 as shown on the framing plans of the contract drawing. In order to prepare the data for processing on the computer, Hamden identified each point of intersection of steel members with an individual number. Note that the lateral bracing system, which appears as the inclined members of the framing plans, was framed into each longitudinal girder, making it necessary to treat each segment of the bracing as a member.

Using input data taken directly from the contract plans and the detailer's work sheets, and programs especially prepared by its staff, the Computer Division produced the complete dimensions and elevations required for drafting of the steel details.

As a first operation a set of coordinates was computed for each number point and the horizontal length of each segment was determined. Typical output for this phase of work is shown on Table A, where the ends of each segment are designated at the left in accordance with the indentification system shown in Plate III and the length in feet is given at the right. In addition the bearing of each stringer, lateral and diaphragm is printed at the far right of the appropriate member.

In the second phase of the computer program, the coordinates of each point were utilized to calculate its station and offset relative to the given base line. The elevation of the top of the slab was then determined, taking into account the variation of the cross section as described on the contract plans as well as the profile.

Table B shows a partial listing of points with the calculated slab elevations shown at the right.

With the information of Tables A and B at hand, the skilled detailer is now ready to create a layout which will enable him to set out the details for fabricating the bridge members.

By utilizing the computer the basic geometry for this viaduct was obtained in just a few days at a cost of less than a dollar per ton of steel. More importantly the computations were done accurately without engaging the services of skilled detailers and draftsmen. This procedure permits greater lead time in placing mill orders and enables the detailer to devote more time to a careful study of his problems. In the unusual case where the information shown on the contract plans is inaccurate or inconsistent, the discrepancies are quickly revealed. By other methods it might not be possible to uncover such errors until long after phases of the detailing work have gotten under way.

With this progressive aid a detailing shop is no longer hindered in its ability to handle complex work by a need for extensive computations. The successful use of the computer in the structure described and many other projects indicates clearly that benefits of the electronic computers are not restricted to the moon and the stars.

COMPUTER FOR DETAILING

STRUCTURAL STEEL

Table A

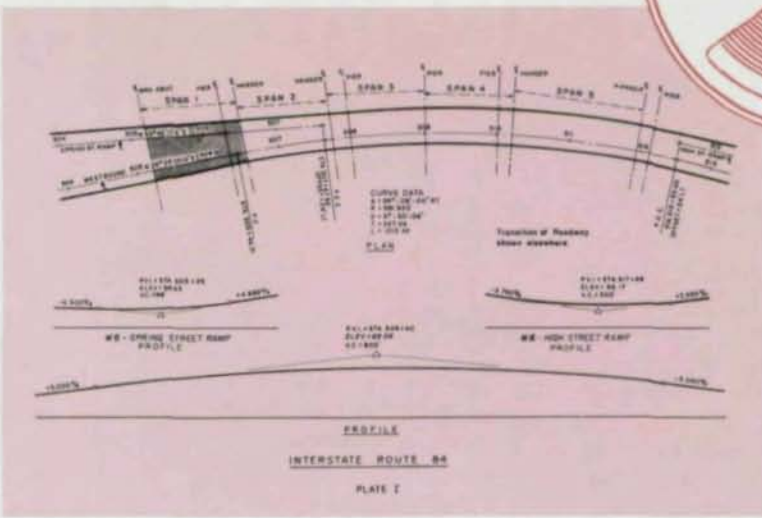
WESTBOUND SPAN 1

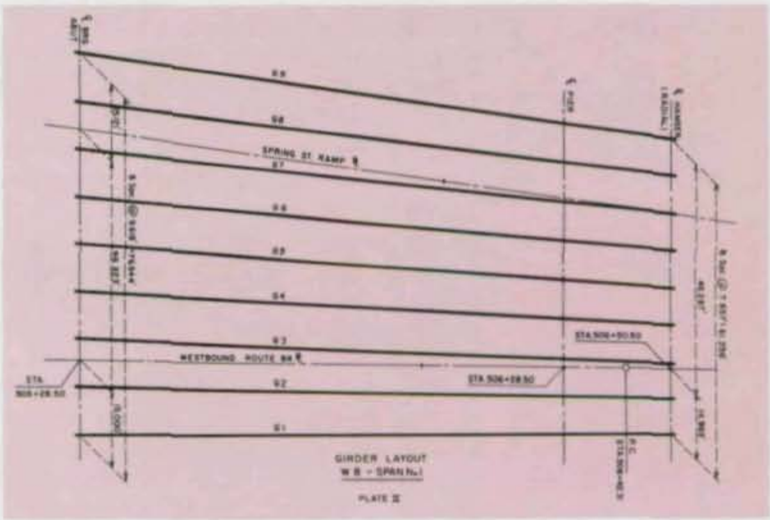
Segment	Length	Azimuth
Member L11		
110-211	10.793	
211-311	10.612	
311-411	10.436	
411-520	10.264	
110-520	42.106	324 22 26.29
Member U11		
520-611	10.815	
611-711	10.996	
711-811	11.181	
811-910	11.370	
520-910	44.363	269 57 52.12

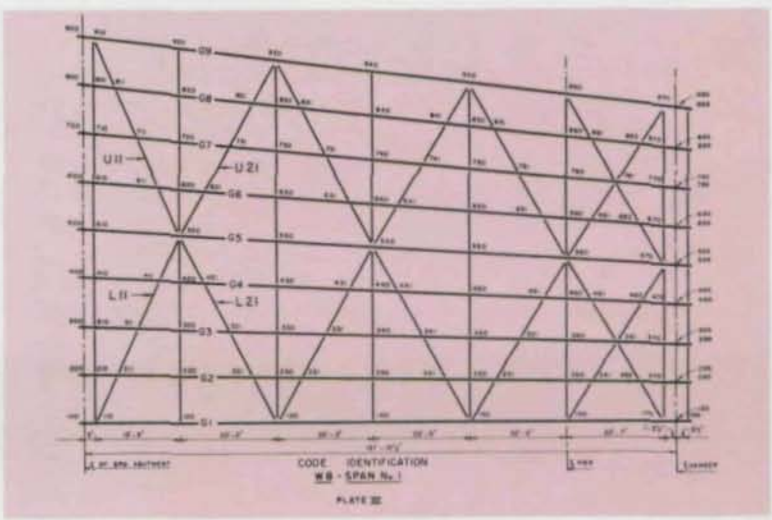
Table B

WESTBOUND SPAN 1

Location	Elevation
100	64.745+
110	64.757+
120	65.683+
130	66.620+
140	67.558+
150	68.474+
160	69.340+
200	64.918+
210	64.930+
211	65.176+
220	65.888+
221	66.621+
230	66.856+
231	67.104+
240	67.821+
241	68.538+
250	68.762+
251	68.996+
260	69.651+
261	69.878+





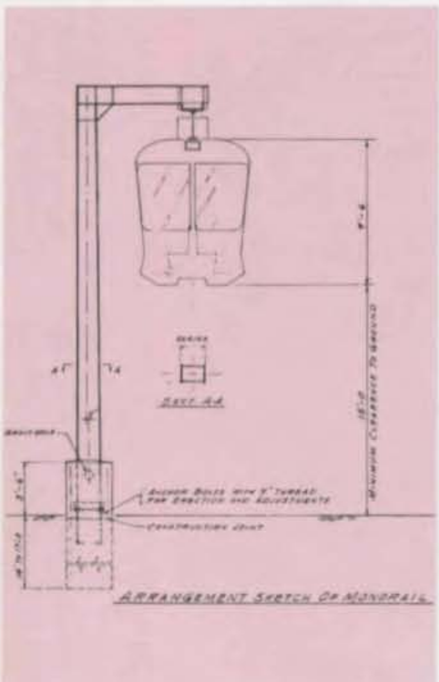


STEEL SHOWS ECONOMY FOR MONORAIL

by Fred G. Sieck
Structural Engineer
Kaiser Steel Corporation

The first suspended monorail constructed in the United States for transporting passengers winds for a mile through the colorful grounds of the Los Angeles County Fair at Pomona, Calif. It was conceived, designed, fabricated and erected in three and one half months, a full two weeks ahead of the opening date of the 1962 Fair.

This exceptionally fast design and completion time could only be accomplished through the use of structural steel for the entire supporting structure. In addition to the advantage of speed of completion, cost studies had proved steel to be the most economical building material, and, as available space for the support structures was limited, the compactness of steel was also of vital importance. On the aesthetic side the slender columns and proportions of the track beams blended in well with the numerous other Fair structures.



Sketch shows arrangement of monorail construction. The car is 9 ft-6 in. high, and minimum clearance to the ground is 15 ft.

The prime contractor for this project, American Crane and Hoist Co. of Downey, Calif., awarded a subcontract to Kaiser Steel Corporation, Fabricating Division, Montebello, Calif., for the design, fabrication and erection of all of the structural steel work.

The sketch gives a graphic illustration of the general configuration as well as the erection method employed. The prime goals were first to obtain maximum speed of erection, and second to insure maximum adjustment possibilities in regard to vertical as well as lateral track location.

The column shafts, averaging 30 ft. high, and the seven-foot cantilever arms are automatically welded box sections. These sections are highly torsion-resistant and thereby provide rotational resistance in the horizontal plane at the beam supports. The column shaft is practically vertical, and the moment produced by a vertical load is therefore constant in the shaft portion. The deflection caused by this constant moment in the comparatively slender column required investigation. A passing car acting with varying loads and corresponding moments on the columns could possibly cause excessive lateral swaying. However, in this particular installation the vibration modes of the columns in combination with the comparitively slow speed of the passenger cars are of such proportions that no sway is felt while riding in the cars, nor is any detected from the outside.

The 40-ft span between columns, which was chosen as basic, permitted I-beam sections rather than more complicated box girders or other composite sections which would have been necessary for larger spans. The bottom flange of the beam thus serves as a track for the car wheels. For reasons of lateral stability, as well as for holding deflection to a minimum, continuity of the track beams at the support points was required. The track beams are made from three plates which are welded together by Kaiser's automatic beam welding machine. By this fabrication method the widths and thicknesses of the top flange plates (determining mainly lateral stability and buckling strength), the widths and thicknesses of the bottom flange plates (determining mainly cross bending resistance and axial tension strength), and the size of the web plates could be designed for their exact functional requirements.

It was evident that the basic 40-ft column spacing could not be maintained throughout the mile-long track. Main track avenues required spans of 75 ft. Photo #2 is illustrative of these spans. The determining factor of all rail beams regardless of span length was the necessity of keeping the width of the bottom flange constant for mechanical reasons. A vertical web space of approximately 20 in. was necessary in order to accommodate the side wheels of the cars. All of these consideration led to the selection of Delta girders for the 75-ft. spans. The triangular upper box section of this girder develops unusual torsional resistance and lateral stability. (See MODERN STEEL CONSTRUCTION Vol. II, No. 2, April 1962, pages 4-5 for a discussion of Homer Hadley's studies of the Delta girder).

The monorail was required to literally "snake" its way through the space-restricted Fair Grounds. For this reason, numerous simple curves and "S" curves had to be designed. Due to the increased stresses acting on the rail beams in the

Photo left shows the monorail as it passes the grandstand on the main concourse of the fairgrounds. Photo top illustrates the loading station, the parking track and the transfer span. Below, a portion of a curved section winds its way through a wooded ravine.

curved area, column spacing was reduced in order to use the same cross section designed for the standard 40-ft spans. Of special interest may be the fact that information concerning stresses on point-loaded beams curved in a horizontal plane could not be located in any available technical literature. The problem is further complicated by the support limitations of this track system. Only the top flange could be connected to the columns.

The solution proved to be quite elementary. It is dependent on finding the shear stresses in the flanges and thereby finding the resulting bending stresses which exist besides the ordinary beam stresses. It can be further stated that continuity of the track beams at the column supports is necessary for the stability of a curved track section. BLH SR4 electrical strain gages were applied in curved sections under fully-loaded conditions after the job was erected. The readings resulting from these tests confirmed the theoretical solution of this problem.

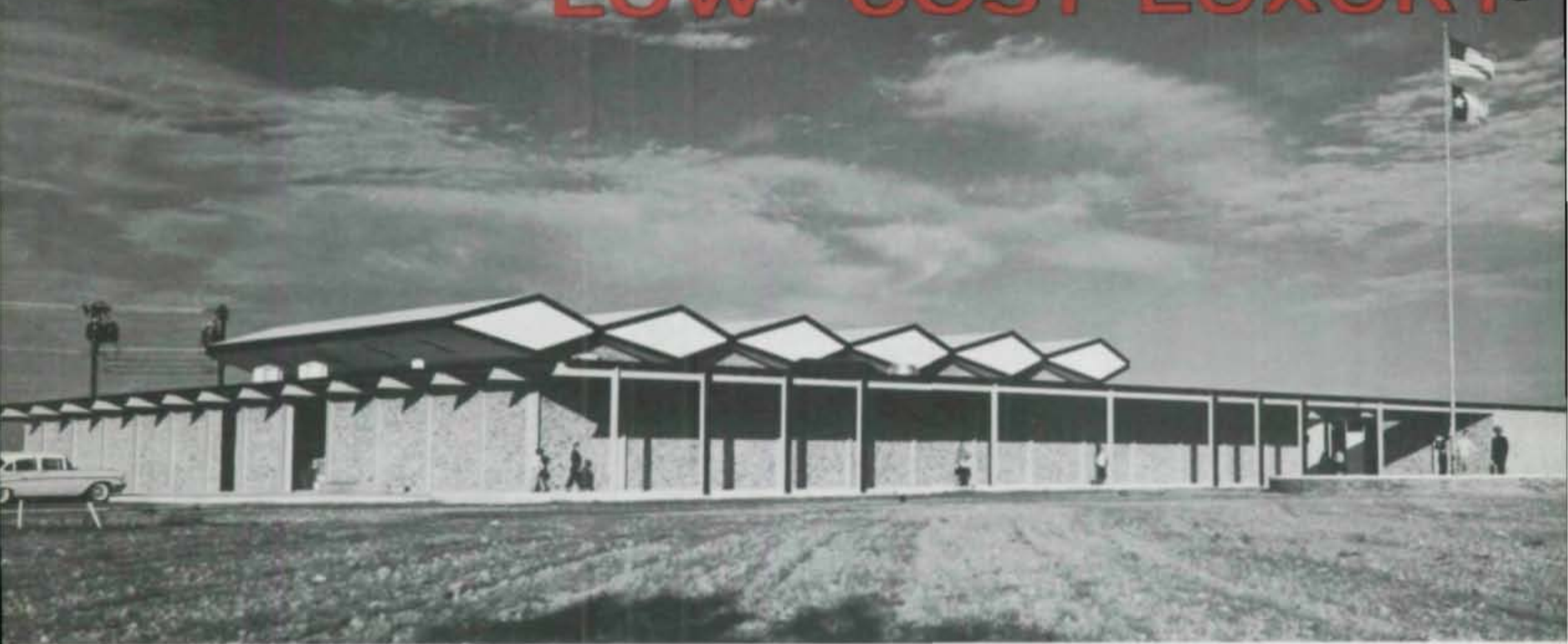
The mile-long monorail is continuous without the introduction of any expansion joints. The elimination of expansion joints was determined by the following considerations:

This track is in operation only once a year during the last half of the month of September. During this time period, temperatures in this part of California normally range from a low of 60° F. at night to a possible 110° F. during the daytime. The erection and closing of the rail system was accomplished in temperatures of 75° to 90° F. The maximum temperature stresses produced under these conditions can in no way endanger the structure. The numerous curves, coupled with the comparatively slender columns, further reduce the temperature stresses. It was expected that slight outside movements of the curved sections would be observable under daytime temperatures of 100° F. and over. This writer was unable to detect any movement under the conditions mentioned. Again, it is obvious that the effect of temperature stresses on long straight runs of overhead monorails would need to be carefully analyzed.

Prior to public use, the complete track system was tested with the passenger cars loaded with double the design live load.

Design a school that looks warm and friendly, make it compact, provide air conditioning and keep costs down. All requests were met for $10.80 per square foot.

LOW-COST LUXURY



Front facade of the Abilene, Texas. Elementary School shows the unusual diamond trusses over the cafetorium.

The solution of an architectural design begins with the formulation and adoption of a detailed program. This program should be a culmination of ideas as expressed by the owner's past experience, the architect's comprehensive knowledge of building design and all pertinent research available on similar projects. Space for fresh, new and practical ideas should always be left open before final adoption of any program. The program for this school sprang from a series of meetings with the architects, superintendent of schools and from the teachers.

Ideas flowed "a plenty"; in fact, shorthand notes were transcribed at each meeting to take advantage of the wealth of information that poured forth. The cries from the teachers rang with such phrases as follows:

"Can we afford air conditioning? My classroom is always dirty from the high winds and sand storms – we have to leave the windows open or we'll suffocate. Wouldn't it lighten the load of the custodians and make a healthier atmosphere for our children?"

"We want more chalk and tack-board space – twice as much, three times, four times – put it anywhere, floor to ceiling, we will use as much as you give us."

"Do we have to have a lot of glass to call a school new and modern? Can you consider glare-reducing glass?"

"I don't like the buildings spread out and completely separated – I want to be able to go from any part of the building to another without going outside. But we want an outside door from each classroom."

"Why is the playground area always forgotten – why not some paved protected areas? Where do you expect the children to play during bad weather?"

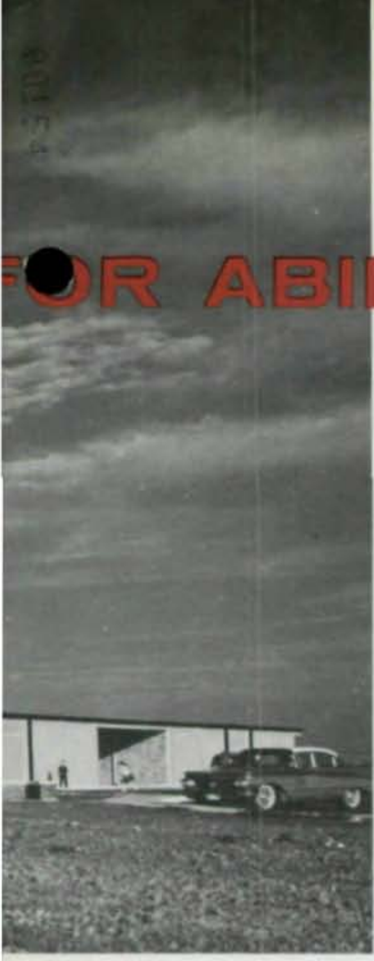
"Does a school have to look like an institution – can it look inviting and not forbidding and cold? Create for us an atmosphere and environment that is colorful and new-looking; then the children will want to attend this school."

"Please give us more work counter space – children learn by doing, not sitting. We need storage cabinets for our teaching aids."

The superintendent and administrative personnel were especially interested in adequate educational facilities and maintenance; and the decree from the school board was: "Keep total cost under $11 per square foot. We are looking out for the taxpayers' dollars and will keep a tight rein on the budget."

With this program as the guide, the architects went to the drafting boards. The solution incorporated the multitude of fruitful ideas. It is simple in its basic form, yet it separates the different instructional, study and activity areas and areas for the community to use. It was during this phase of the design that the service entrance, student loading and unloading, and playground areas were established. With an eye toward the future, in a city whose population doubled in the last ten years, adequate facilities were provided for the eventual growth to a 24-classroom plant.

Upon completion of the preliminaries, the ideas now translated into drawings were presented to the teachers, superintendent and the school board for their views and critique. With the enthusiastic

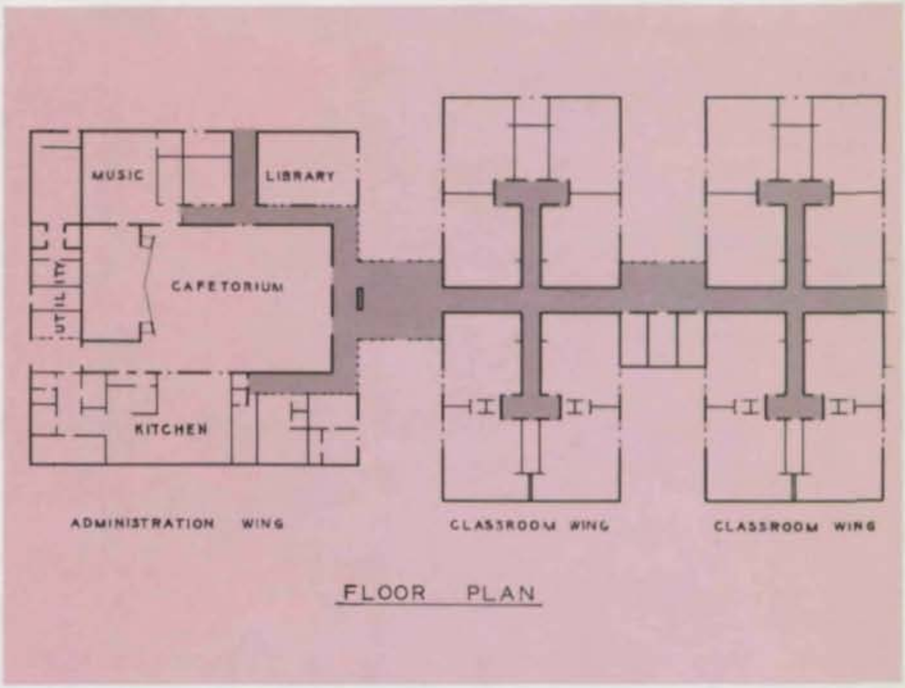


OR ABILENE SCHOOL

approval of this group and a vote of confidence that it was a fresh, new and practical solution, the architects proceeded into the detailed design stage.

"Can we afford air conditioning?" asked the teachers. This particular item aroused more interest and was by far the most desired item requested in the new school which was to be built in an area where 90 per cent of the homes and 75 per cent of the new cars are air conditioned. The school board was also in favor of the air conditioned school with only one little qualification: "Build it within the budget and at the same square-foot cost that our non-air conditioned schools have been costing. We cannot ask the taxpayers for any more money when we are so short of classroom space."

With this in mind the architects designed an air conditioned school — not one where air conditioning could be added, for this is a compromise, but one that included all of the multiple advantages which are gained when the air conditioning is included in the initial design stage.



Floor plan (above) demonstrates how architects solved the problem of access from any classroom to the rest of the building as well as egress from each room to the outdoors. Interior court (below) shows detailing of the structural steel as well as exterior panels of exposed aggregate finish. Panels were cast at the site, then lifted and bolted to the steel frame.

Gray glass was deemed to be a necessity after listening to the teachers' many and vehement complaints about bright and glary glass. With the decision that the building was to be air conditioned and with the plea from the teachers for more chalk and tack board space, it was decided to reduce the total amount of glass. This reduction would automatically reduce the total air conditioning load and provide a great deal more space for chalk and tack boards. In fact, complete elimination of all glass was investigated; but this proved not to be the answer, for the teachers felt this would create many psychological problems.

The pleas from the superintendent and administrators centered around designing a building that was easily maintained. The floors and walls of the hard usage areas (corridors, rest-rooms, entries, kitchen, etc.) demanded special attention, and hard, impervious and glazed surfaces were the answer.

The challenge then became one of designing an extremely simple school plant, one that was repetitious and labor-saving yet not sterile or cold in appearance. The use of good, low-cost, struction methods would also be a factor in keeping the project within the tight budget. It was determined that the most logical place to take advantage of the above savings was in the structural framing design and the wall construction.

After many basic studies, layouts and cost estimates, it was determined that a repetitious light steel frame would be the most economical and fastest construction method. With this type of structural system, there was no necessity for building a heavy, thick, load-bearing wall. Panel wall construction seemed like a logical choice if the cost could be reasonable. After a great deal of research into different kinds of panels and construction methods, it was determined that cast-concrete tilt-up wall panels were the most economical, flexible and speedily erected.

Classrooms feature gray glass to cut glare and as much tackboard and counterspace as could be provided. Ceilings are of exposed formboard and acoustical plaster.

locally available materials and fast con-

Lighting for general illumination is fluorescent with incandescent accents. A complete sound, clock and bell system is provided to all portions of the building complex.

Complete parking facilities for teachers and guests have been provided and paved. Loading, unloading and service areas have been developed. Site work included in the project cost amounted to $11,500.00. Plans are now in progress for the landscaping and playground development.

There are now 16 classrooms with provision for expansion to 24 with space for 720 pupils. Other facilities include music, library, cafetorium, kitchen, athletic dressing, administrative, storage.

Cost per square foot for the initial facilities were $10.80 psf or $395,621 including kitchen equipment, site, electrical and mechanical work. This is not a true reflection of the eventual cost which is estimated at $500,000 and $10.60 psf.

Structural engineer was Jerry Rosser, general contractor: White & Everett, and the structural steel were fabricated and erected by Central Texas Iron Works. All the firms are based in Abilene.

Outline of Construction Materials:

- **Foundation:** Drilled piers 15 ft deep to shale.
- **Floor:** Terrazzo and asphalt tile over concrete slab.
- **Exterior Walls:** Pre-cast concrete panel.
- **Interior Walls:** Pre-cast concrete panels on 2 x 4-in stud walls with ceramic tile or plywood facing.
- **Structural System:** Complete steel frame.
- **Roof Deck:** Lightweight poured gypsum deck on one-inch formboard.
- **Roofing:** 20-year-guarantee built-up.
- **Heating and air conditioning:** A complete year-round multi-zone system. Each and every classroom is on a separate zone and each classroom automatically receives heating or cooling as required to satisfy the desired temperature. Each air handling unit has a 100 per cent ventilation cycle providing from 25 per cent to 100 per cent automatic ventilation depending upon the outside temperature. The total air conditioning capacity is approximately 140 tons.

MIES EXPRESSES STEEL STRUCTURE

by Olindo Grossi

"Skyscrapers reveal their bold structural pattern during construction. Only then does the gigantic steel web seem impressive. When the outer walls are put in place, the structural system, which is the basis of all artistic design, is hidden by a chaos of meaningless and trivial forms. When finished, these buildings are impressive only because of their size; yet they could surely be more than mere examples of our technical ability. Instead of trying to solve the new problems with old forms, we should develop the new forms from the very nature of the new problems."

This opinion, expressed 40 years ago by Ludwig Mies van der Rohe, has been reflected in many of his office buildings and later imitated by other architects. But in 1922 this simple directness, which has characterized the architect's whole life, erupted abruptly on an unsuspecting world. It was one of five inspirational statements which he contributed to the revolution in modern architecture. Any one of these—three office buildings and two country houses—would have been sufficient to insure his lasting prominence in twentieth-century architecture, but, as becoming a great pioneer (Wright, Le Corbusier), he has remained a leading thinker 40 years after his brilliance became known.

While steel and glass factory buildings were known before 1919 when Mies designed his first office building for the Friedrichstrasse in Berlin, he was the first to propose this exterior for offices. It is that initial statement of "skin and bones construction" which the Home Federal Savings and Loan Association Building in Des Moines carries as the unmistakable mark of Mies authorship. Here he has presented a design of succinct purity which architects and critics have come to expect in his buildings.

As in the case of his better known and larger buildings, such as 860 Lake Shore Drive apartments in Chicago and the Seagram Building in New York City, the architect has used steel as an aesthetic as well as the structural element. Following his personal motto "less is more," he has eliminated unessentials to produce another structure of elegant simplicity.

Instead of resorting to decoration and ornamentation, as is the custom of lesser craftsmen, he has relied on the development of fine proportions and studied details to articulate structural columns, mullion bracing and floor and roof planes. Here again is illustrated his detailing and determination to maintain the purity of design. The result is completely successful.

The basic rhythm of the building is a simple modular expression in steel in wholesome and economic 40-ft square bays. When concrete fireproofing covers structural steel columns, additional steel has been used as an aesthetic element. The exterior walls are architecturally exposed steel with floor-to-ceiling plate glass. Exposed steel includes spandrel plates, column cover plates and mullions. The three bands of steel spandrel plates express both the clean aesthetic demanded by the architect and a sturdiness the eye expects, while

Olindo Grossi is dean of the School of Architecture at Pratt Institute in Brooklyn. He also serves as architectural consultant for Modern Steel Construction.

the vertical mullions from the second floor to the roof are used to express the quality of steel itself.

For the first time Mies has chosen to use cold-rolled steel for selected applications because it provides a much sharper edge than hot-rolled steel. He succeeds handsomely with this device in the window frames of the recessed windows on the first floor. Other detailing of architecturally exposed steel required expert finishing of welded flush joints and perfect horizontal alignment of spandrel plates.

The floor system in the third-floor mechanical space is composite with shear connectors on the top flanges where necessary. Cellular decking was used in other areas above the first floor.

Another feature of the building includes the window washing arrangement whereby stub columns have been installed around the roof's perimeter with horizontal beams between them for cleaning equipment.

The Home Federal is a 120-ft-square set up on a meter grid which established the basic rhythm. The building itself—three stories and the basement as well as a penthouse for mechanical equipment—has about 65,000 sq ft of floor space and cost approximately $2,000,000.

On the interior the architect included standard items of convenience and comfort such as individually controlled air conditioning with both heating and cooling and an under-floor electrical equipment system allowing flexibility in placement of furniture and machines. In the basement there are dining facilities as well as a lounge.

Mies has again turned to steel to reflect his philosophy of what a building should be. The steel column and the applied exterior mullions "express" the steel structure. This license in a disciplined aesthetic is not only permissible but very welcome for it relieves the sterility of the purely "formula" approach. Because of this ability to express steel as a structural element, the American Institute of Steel Construction awarded the German-born but naturalized-American citizen the J. Lloyd Kimbrough Gold Medal "for pioneering an architectural tradition dedicated to the honest expression of structure through an authoritative use of the technology of America's structural steel industry." Mies was the first architect ever to receive this gold medal, and The Home Federal Savings building is further testimony that his selection was appropriate and fitting.

There can be little doubt that the genius of Mies accurately reflects the technology of our age. Both simplicity and modular repetition are highly developed while aesthetic refinements (still in the tradition of this technology) have been added relieving the building of a mathematical appearance. The use of steel has resulted in a lightness of structure that permits the open plan—also long championed by Mies—permitting flexibility, the sense of larger space and relief from clutter.

The granite plaza on Grand Avenue with its 46-ft setback is a welcome addition in community design. This and the fine aesthetic qualities of the building help pace the construction growth in Des Moines.

719 tons of steel used
539 tons are in frame
180 tons are exposed

steels used
520 tons of A7
170 tons of A36
29 tons of A108

All A36 specified for framework beams 24 in. and over
The remainder of frame—369 tons—is A7.

Architecturally exposed steel—151 tons A7.
Remaining 29 tons are cold-finished A108.

Composite beams with shear connectors on the top flanges have been used throughout the building to bond into the concrete when these beams are fireproofed.

Beams were not shop painted.

Exterior of building is a combination of steel plate curtain wall and glass. The steel curtain utilizes spandrel plates, columnar cover plates and exposed structural mullions.

Framing beams have holes cut and reinforced in them by the fabricator to allow duct work to go through the beams.

Floors: Cellular deck with concrete except first floor, where granite was used.

Fireproofing: concrete on composite beams and fibre fireproofing elsewhere

Roof: lightweight four-inch concrete slab

Doors: Stainless steel, floor to ceiling 9½ ft

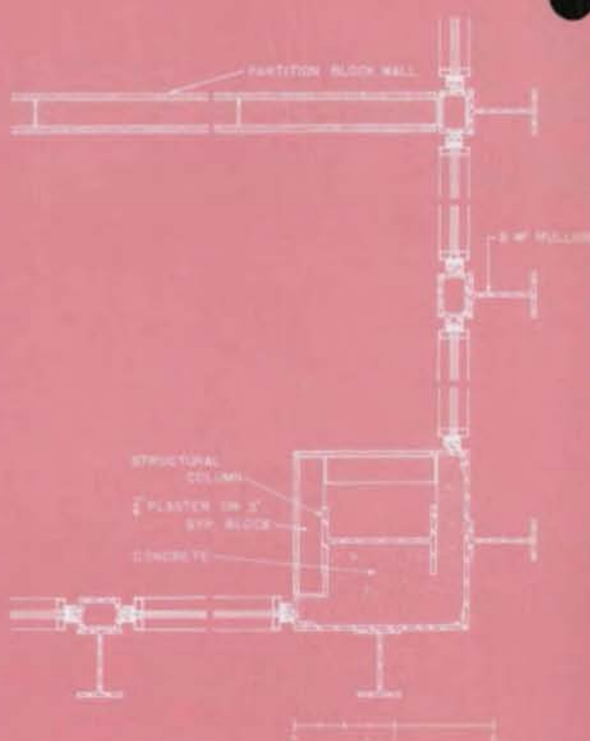
Windows: ASTM 108 steel frames on first floor.
aluminum frames on 2nd and 3rd floors.

Associate Architects: Smith-Voorhees-Jensen, Des Moines

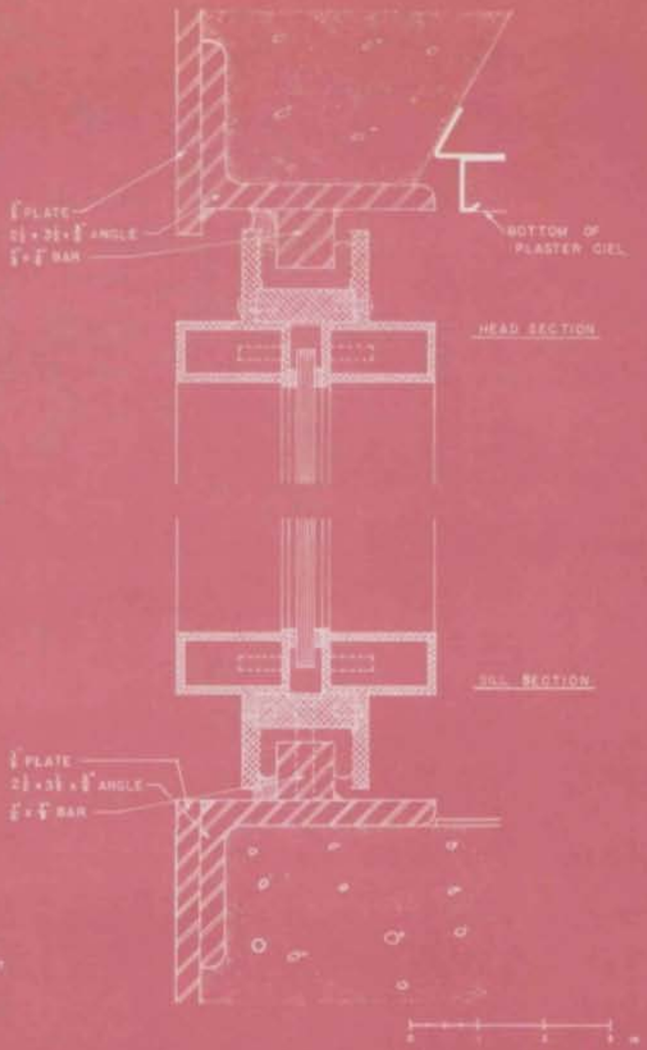
Structural Engineer: Nelson, Ostrom, Baskin, Berman and Associates, Chicago

General Contractor: Ringland-Johnson, Inc., Des Moines

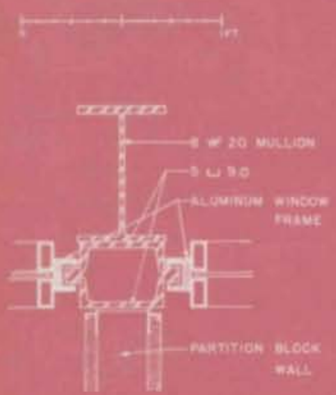
Structural Steel Fabricator: Des Moines Steel Company



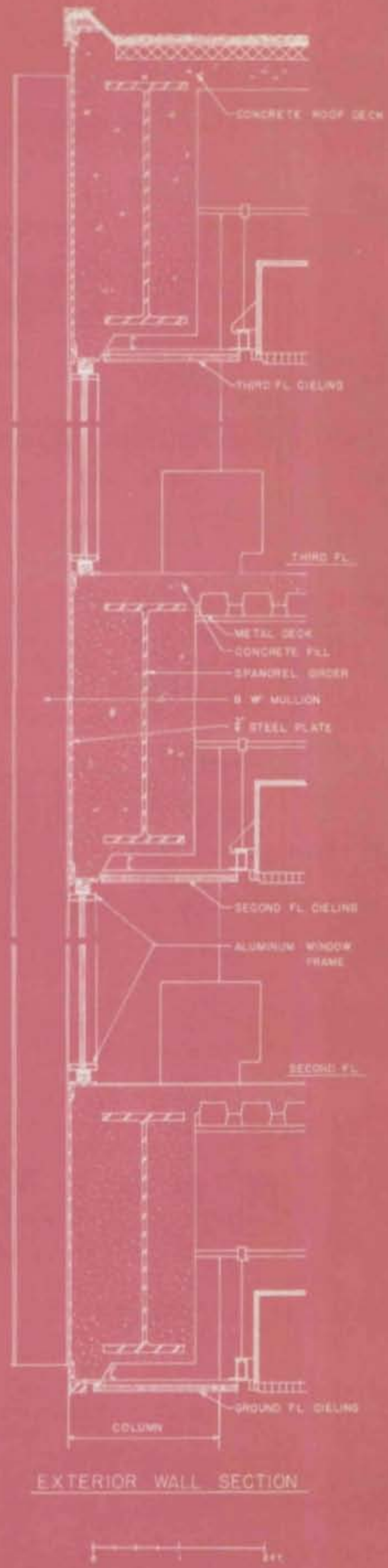
PARTIAL PLAN



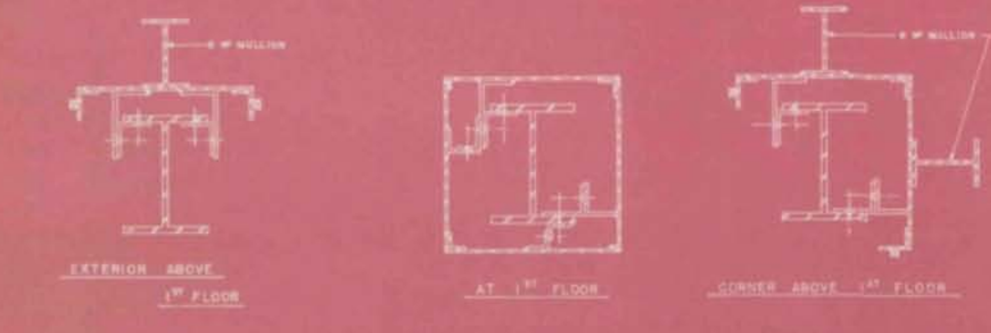
ALUMINUM WINDOW FRAMES



TYPICAL EXTERIOR MULLION



EXTERIOR WALL SECTION



EXTERIOR ABOVE 1ST FLOOR

AT 1ST FLOOR

CORNER ABOVE 1ST FLOOR

TYPICAL COLUMN SECTIONS

QUESTIONS & ANSWERS on the AISC Spec

Q. A column is subject to two bending moments — one caused by gravity loads and one caused by wind loads. The bending term of Formula (6),

$$\frac{C_m f_b}{\left(1 - \frac{f_a}{F'_e}\right) F_b}$$

would appear twice, once for wind load and once for the gravity load. Should the factor F'_e be multiplied by 1.33 in both bending terms or only in the bending term referring to the wind load?

A. When the working stresses produced by a combination of wind and gravity loads are increased ⅓, this merely means that the factor of safety has been reduced 25%. If the section selected to support the combined wind and gravity loading at this lower factor of safety is no smaller than would be required to carry the gravity loads alone without a reduction in factor of safety, the ⅓ increase applies to all stresses. When F'_e is defined as $149{,}000{,}000/(l/r_b)^2$, the factor of safety corresponding to gravity loading has been applied. Therefore, when Formula (6) is used to test the adequacy of a member in supporting combined wind and gravity load, F'_e should be increased ⅓ for all bending terms.

Q. The definition of a "compact section" in Section 2.6 includes the provision that the projecting element under compression (flange) shall have a width-thickness ratio of 8½ or less. Can a non-compact section be designed as a compact section (either under plastic or elastic design rules) if a portion of the flange is *considered* removed?

A. No. Research has shown that local buckling can occur at stresses near yield point when the provisions of Section 2.6 are exceeded. The 10 percent increase in allowable bending stress permitted for compact sections contemplates that the member may be stressed to yield point throughout the entire cross section without buckling locally. In addition to supporting the moment which would cause plastic yielding the section must be able to rotate plastically enough to redistribute any additional moment due to greater loading — without lateral buckling.

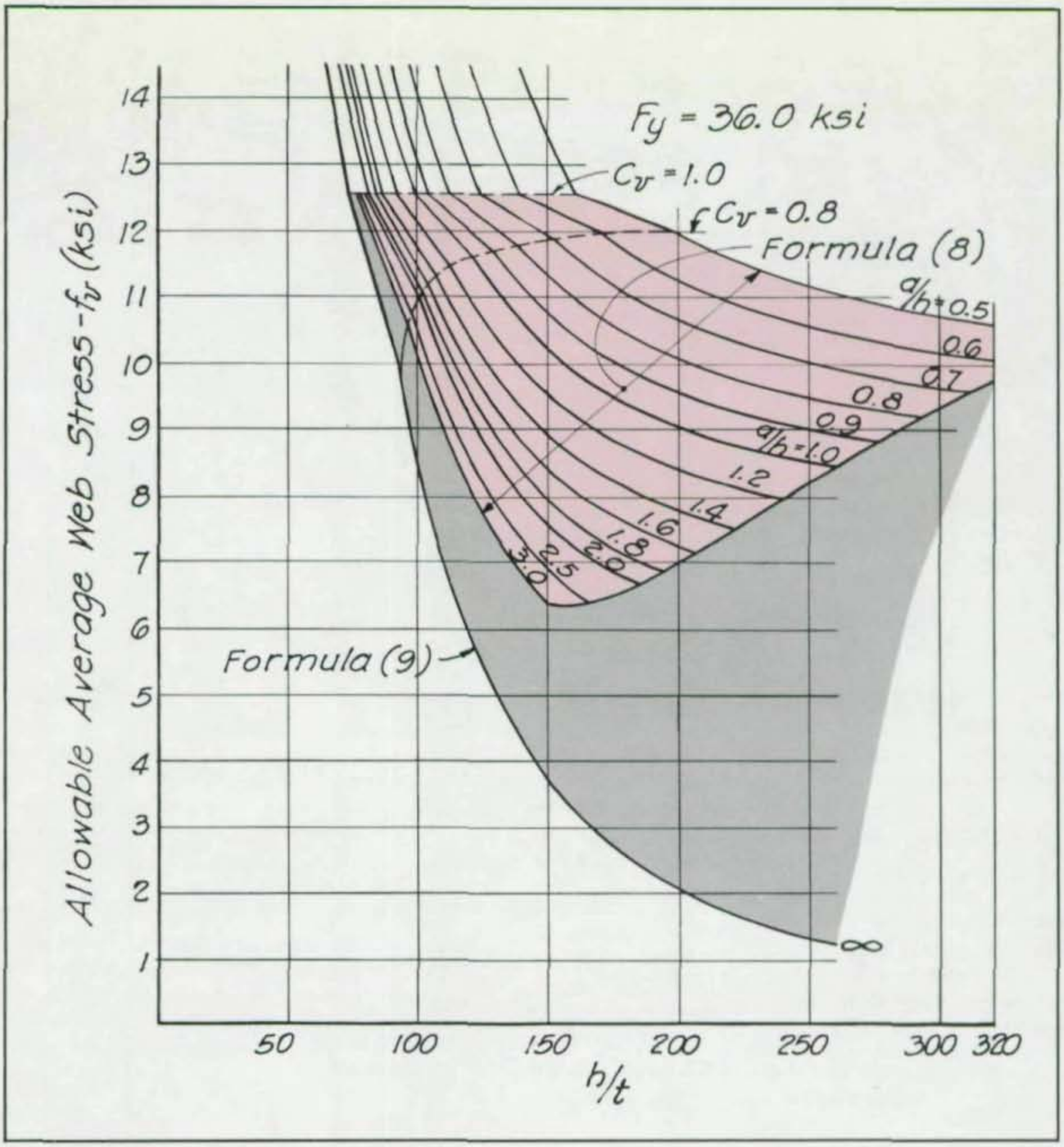
Q. Section 1.23.6 states that, "Base metal shall be preheated as required to the temperature called for in Table 1.23.6 prior to tack welding or welding." Why is tack welding included in this preheating requirement?

A. If the tack welds will not be later incorporated into finished welds carrying calculated stress, the provisions of table 1.23.6, relating to preheating need not apply.

Inclusion of tack welding in the general provision was intended to avoid the possbility of cracked welds being covered up later by structural welds which, even though they had been laid down at the prescribed preheat, would thus contain serious weaknesses.

Q. What is the allowable bending stress of a tee section: 1) when the flange is compression and 2) when the stem is in compression? Assume continuous lateral support such as the top chord of a truss or a cantilevered canopy.

A. Section 1.5.1.4.4 would apply: $F_b = 0.60\ F_y$. Since the section modulus of a tee is usually smaller referred to the outermost fiber of the stem, this would control whether the stem or the flange was in compression. Tee sections (and pairs of angles) have good torsional properties when used as beams, unless there is eccentricity in the loading. This is particularly true when the flange of the tee is stressed in tension and the compression stress, due to bending, is maximum at the bottom of the stem. This can be checked by using Equation 4.26 on page 70 of the Column Research Council book, "Guide to Design Criteria For Metal Compression Members" and computing the properties of the tee according to the formulas given in Fig. 4.10, taking the compression flange area as zero.



Q. How can stiffener requirements for a plate girder be easily determined?

A. The figure above plots allowable web shear against h/t ratios using Formula (9) and a family of curves of Formula (8).

The allowable web shear where no "tension field" action is counted upon is represented by the white portion of the diagram. For example, if a girder has a web depth to thickness ratio (h/t) of 150, the allowable web shear would be about 3.7 ksi with no "tension field" action and no intermediate stiffeners required.

The family of Formula (8) curves, in the red area, represents the condition where "tension field" action is utilized. The allowable shear can be easily determined for various combinations of h/t and a/h. These curves are terminated at their lower end by the provision of section 1.10.5.3 which states that the ratio a/h shall not exceed $\left(\frac{260}{h/t}\right)^2$ nor 3.00. The formula (8) curves are terminated at the upper end by Cv = 1.0.

The gray area in the diagram represents a/h and h/t values not permitted by the Specification.

newsbriefs

STAINLESS STEEL FOR IBM BUILDING

The diamond-shaped steel grid of Pittsburgh's IBM building disappears behind a sheathe of stainless steel after being coated with fireproofing asbestos plaster. While the steel frame was exposed, USS's American Bridge Division, steel fabricator and erector, painted the load-bearing truss walls different colors to demonstrate how modern steels combine to achieve both economy and dramatic architectural design. The building's design will be discussed by the architect and engineer at AISC's National Engineering Conference in Tulsa, Okla.

ARCHITECTURAL AWARDS FOR 1963

Architects and engineers are invited to submit entries in AISC's fourth annual Architectural Awards of Excellence program. Formal announcements and rules will be mailed shortly. Deadline for entries of building completed in 1962 is May 15.

NEW FIREPROOFING PAINT INTRODUCED

The first commercial application of a thin, paint-like fireproofing to meet code requirements was sprayed on 1900 sq ft of columns for the Pittsburgh Plate Glass Company warehouse in Hartford, Conn. The twenty-eight, 20-ft-high, 6 x 6 WF columns were covered in two days. On gallon of the febrous mastic, ALBI-CLAD, covered 20 sq ft.

NEW MANUAL FOR BRIDGE DESIGN

A **Design Manual for Orthotropic Steel Plate Deck Bridges** has just been published by the Institute. The book reviews the theoretical and historical background and gives design criteria and practical design procedures illustrated by numerical examples. Engineers will find the Manual an essential guide to efficient, economical design. Copies at $10. each are available through AISC in New York.

FIRST STEEL FOR ST. LOUIS ARCH

In mid-February the first 40-ton triangular section of the Jefferson National Memorial was set in place by Pittsburgh-Des Moines Steel Company. The Saarinen-designed arch will soar 630 ft above the park on the St. Louis waterfront and will contain 4000 tons of steel. The all field-welded structure will be completed in 1964 for the Bicentennial celebration.