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## STRUCTURAL SYSTEM AND ARCHITECTURAL FORM RELATIONSHIP IN CONTEMPORARY ARCHITECTURAL APPROACHES

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The aim of this paper is to discuss the effect of structural system on the architectural form of contemporary buildings. Paper consists of two main parts. The first part includes definition of structural system and architectural form relationship for different building scales. This definition depends on visibility of structural form and/or confusion of it with architectural form. In the second part examples of contemporary architecture are evaluated from the point of view of structural system and architectural form relationship.

The architectural form which is the base of architecture, includes structural form which is the form of structural system. Architectural form consists of three, two and one dimensional components and each component consists of structural and nonstructural components. Components of architectural form are as following (Figure 1):

- Architectural mass form,
  - Scale,
  - Proportion,
  - Geometric property,
- Structural mass form,
  - Scale,
  - Proportion,
  - Geometric property,
- Form of the masses added to the structural mass form,
- Form of the masses which are subtracted from the structural mass form,
- Form of addition of structural members,
- Form of additions in the form of surfaces,
- Form of structural members,

- Form of additions in the form of lines.

The following architectural form components are structural form components.

- Structural mass form,
- Scale,
- Proportion,
- Geometric property,
- Form of addition of structural members,
- Form of structural members.

The relationship between architectural and structural form can be handled in two ways. The first is the effect of structural form possibilities on architectural form possibilities. If architectural form possibilities of a structural system are less than another system, it can be said that, effect of structural form possibilities of the first one on the architectural form possibilities is more than the second ones. The second is the dominance of structural or architectural forms. This kind of a relationship between architectural and structural forms is dependent on the architectural approach. For example, a building can both have the properties of dominance of structural form and having a kind of structural system which has the maximum number of architectural form possibilities.

The technological factors that affect the architectural form possibilities are production methods, structural, constructional and mechanical systems. Structural system may determine architectural form possibilities only in the cases in which cost determining technological factor is the structural system. For example, for high rise and long span buildings, structural system determine architectural form possibilities (1) (2). For ordinary buildings, the cost determining factors are production methods and constructional system.

Structural and architectural forms can be different from each other even in the cases in which structural system determines architectural form possibilities. Because, architectural form may include additions and substructions in the form of mass, and additions in the form of surface and line besides structural form (Figure 2).

Structural form can be dominant on architectural form, in the following cases.

- For the cases in which components of architectural form are not used as a means of expression, structural form components must be visible in order to be accepted as dominant. This is mostly seen in the Purism like Modernist architectural approaches.
- For the cases in which components of architectural form are used as

a means of expression, structural form components must be used as a means of expression in order to be accepted as dominant. This kind of an approach was accepted after 1960's.

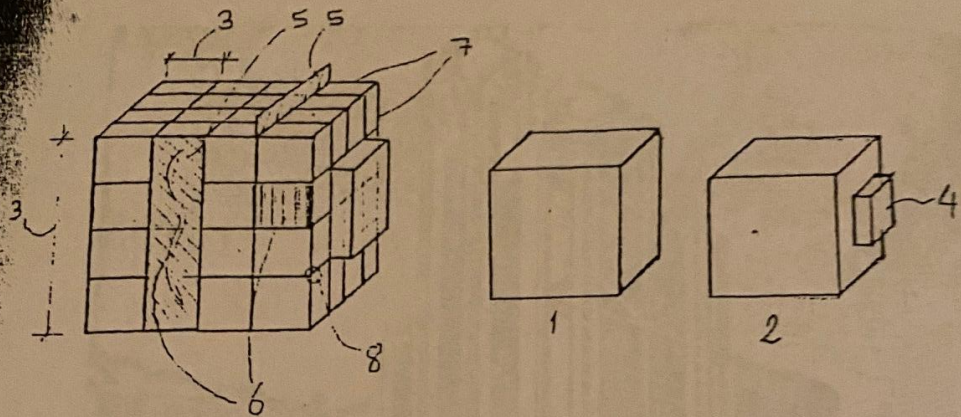
Forms of the components of structural form must not carry the technologically optimum form properties and they must be visible, in order to be accepted that they are used as a means of expression. If there is a possibility for them to be confused with other architectural form components, these can also be accepted as a means of expression.

Contemporary architectural approaches can be classified as the architectural approaches which are the continuation of Modernist approaches, Classicist approaches and Deconstructivism. Typical examples of these approaches and evaluation of them from the point of view of architectural and structural form relationship, can be seen in Figures 3 through 16.

As will be seen in Figures 3 through 16; except High-tech examples in which structural form is exaggerated and Late Modernist examples like R. Meir's, architectural form is dominant on structural form.

Depending on the use of architectural form components, buildings shown in Figures 3-16 can be classified as following.

- Smith House,
- New Medical Faculty Binasi,
- Henwood House, Tate Gallery, Institut Du Monde Arabe,
- Folie 96, American Academy of Pediatrics, Hong Kong Bank,
- Project for Kurt Foster, Bonaventure Hotel, Z Bank, Spiral Building, Addition to Senate Building, Amvest Headquarters.



1. Geometric property of structural mass form
2. Geometric property of architectural mass form
3. Scale
4. Form of additions in the form of mass
5. Form of additions in the form of surface
6. Form of additions in the form of line
7. form of structural members

Figure . Some components of architectural form

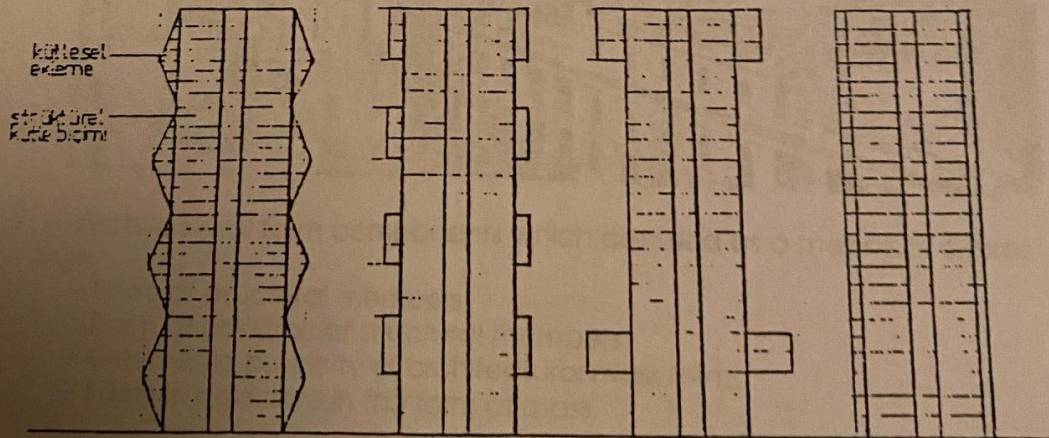
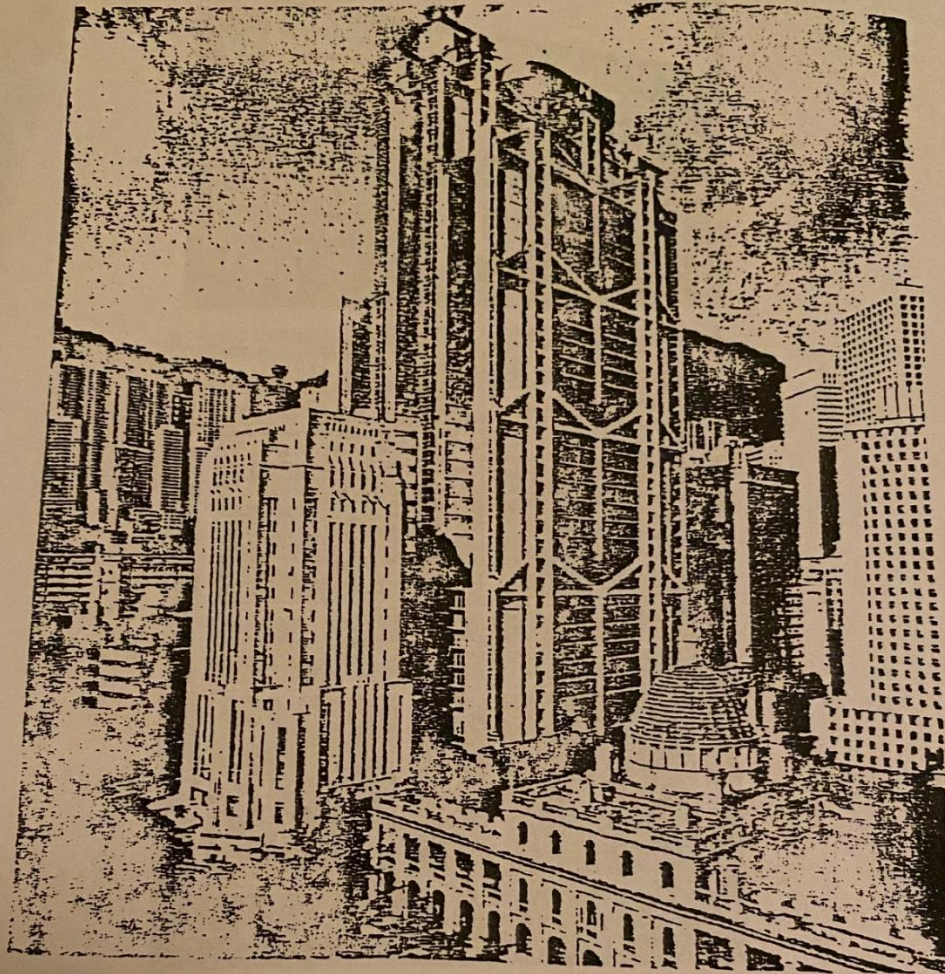


Figure 2. Differentiation examples of structural and architectural form



Architectural form components which are used as a means of expression:

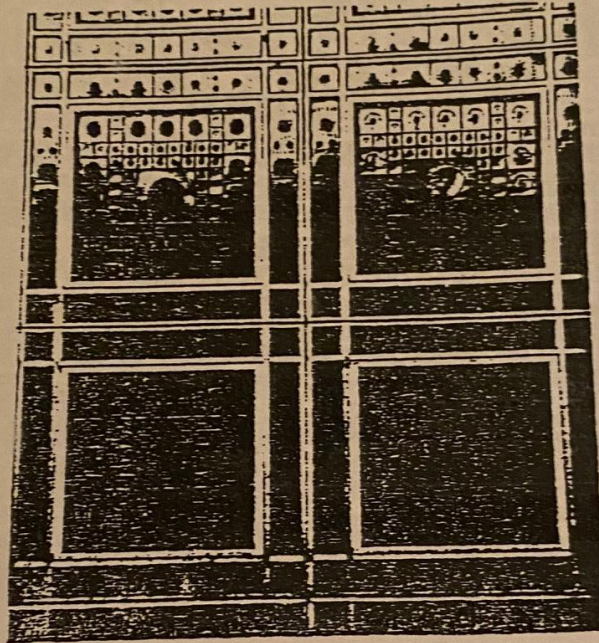
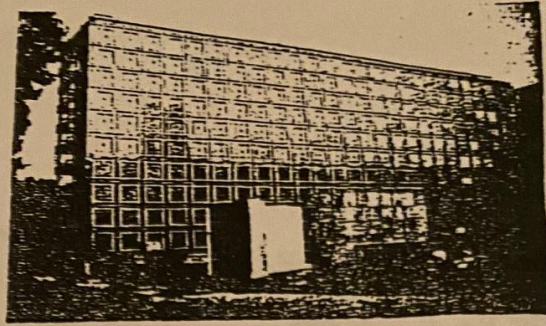
- Form of structural members,
- Form of addition of structural members,
- Geometric property of architectural mass form,
- Form of additions in the form of mass.

STRUCTURAL FORM COMPONENTS ARE DOMINANT

Hongkong Bank, Hong Kong, 1980-86, Norman Foster

Figure 3.A High-tech example in which structural form is exaggerated

(3)

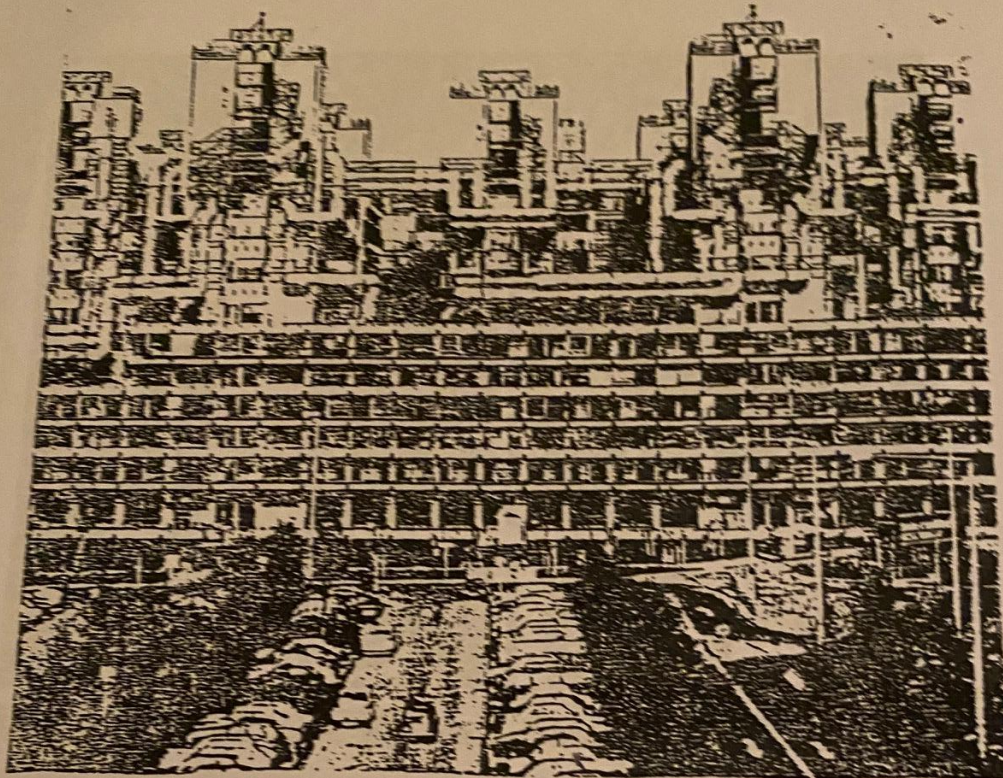


Architectural form components which are used as a means of expression:

- Form of additions in the form of surface,
- Form of additions in the form of line.

ARCHITECTURAL FORM COMPONENTS ARE DOMINANT  
Institut du Monde Arabe, Paris, 1984-87, Jean Nouvel

Figure 4.A High-tech example in which constructional system is a means of expression (3)



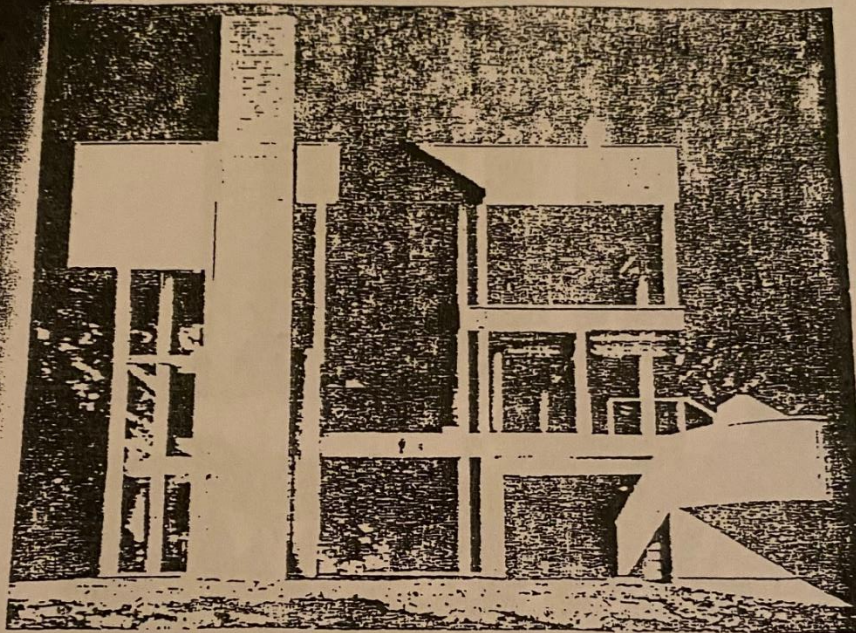
Architectural form components which are used as a means of expression:

-Mechanical system

MECHANICAL FORM COMPONENTS ARE DOMINANT

New Medical Faculty Building, Aachen, 1969-84, Weber, Brand & Partners

Figure 5.A High-tech example in which mechanical system is a means of expression (3)



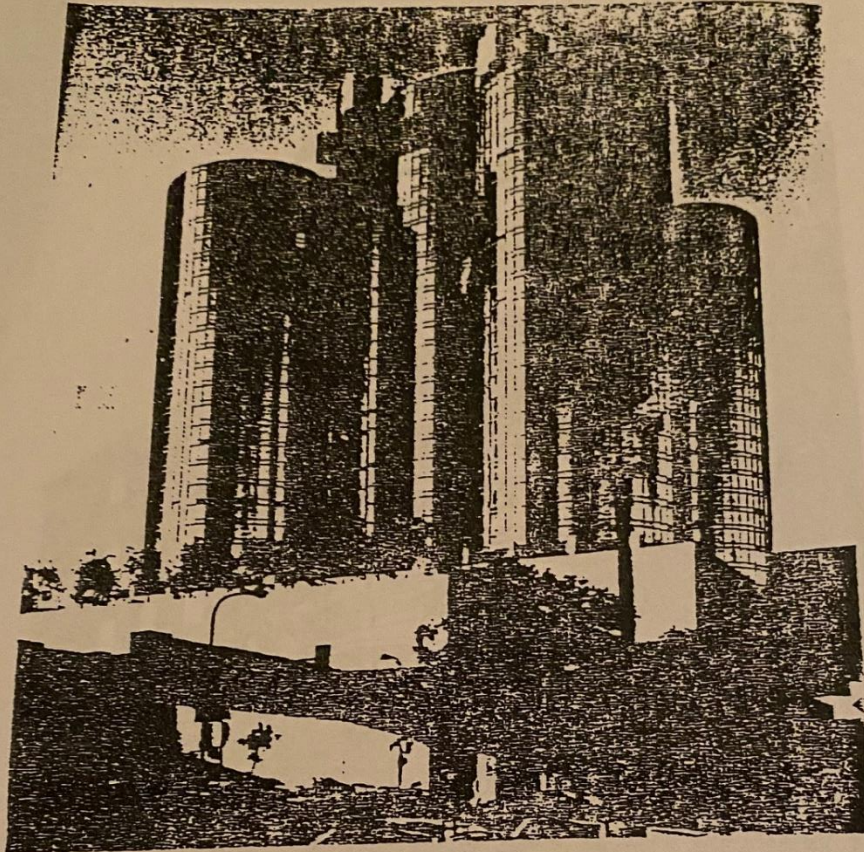
There is no architectural form component used as a means of expression.

STRUCTURAL FORM COMPONENTS ARE DOMINANT

Smith House, Connecticut, 1965–67, Richard Meier

Figure 6.A Late Modernist example in which structural form is visible (3)





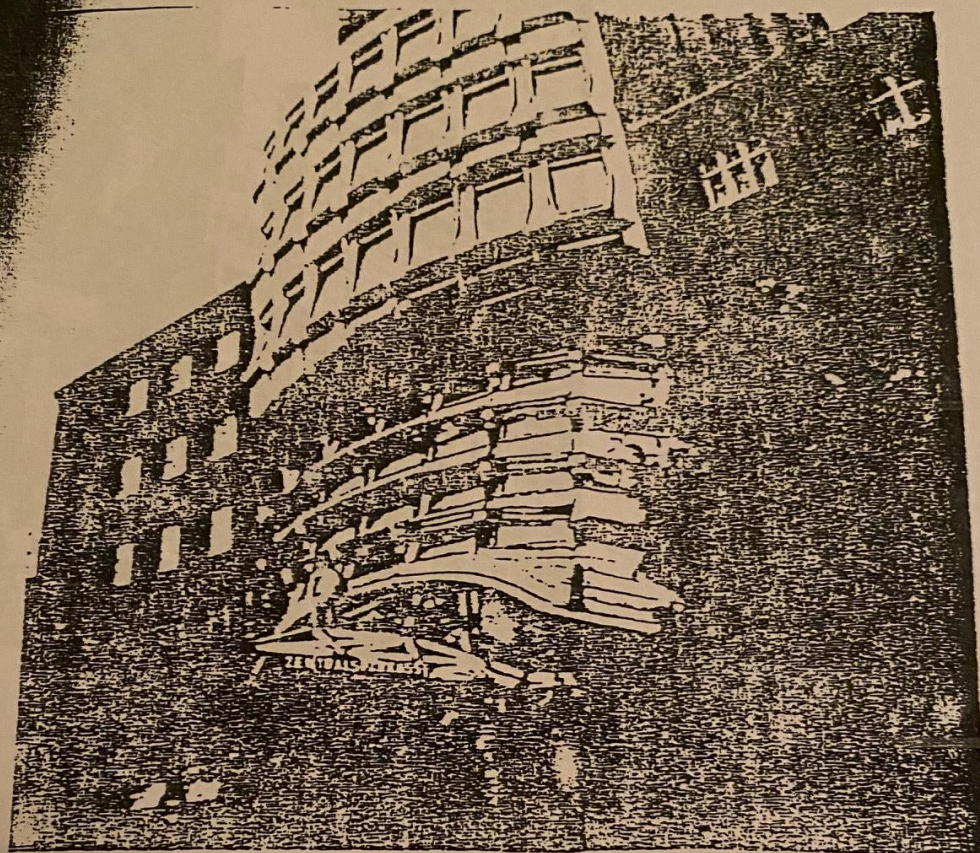
Architectural form components which are used as a means of expression:

- Geometric property of architectural or structural mass form,
- Form of additions in the form of mass,
- Form of additions in the form of surface.

ARCHITECTURAL FORM COMPONENTS ARE DOMINANT

Bonaventure Hotel, Los Angeles, 1974-77, John Portman and Associates

Figure 7. A Late Modernist example in which geometric property of architectural mass form and form of additions in the form of surfaces are used as a means of expression in order to express technology (3)



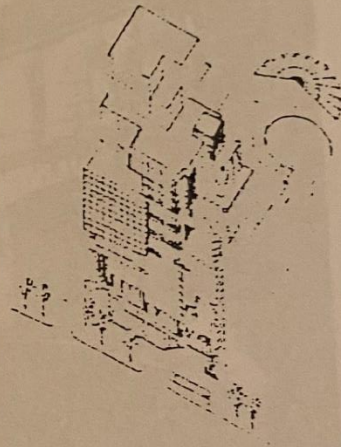
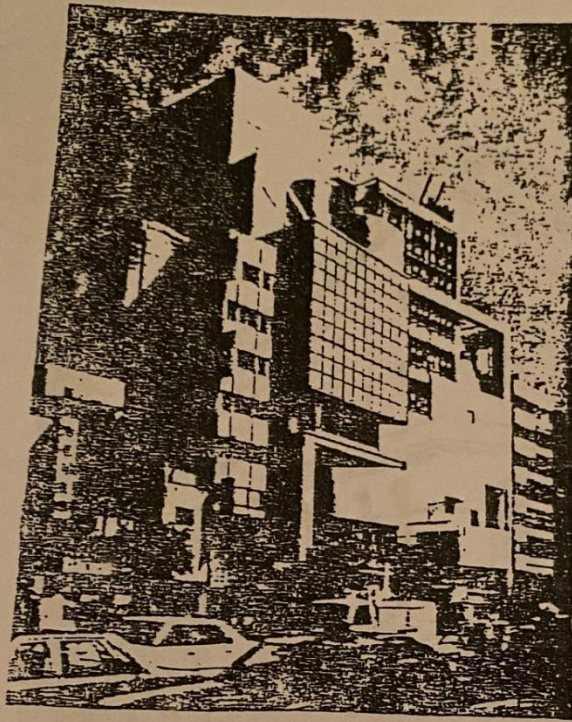
Architectural form components which are used as a means of expression:

- Geometric property of architectural or structural mass form,
- Form of additions in the form of lines,
- Form of additions in the form of surfaces.

ARCHITECTURAL FORM COMPONENTS ARE DOMINANT

Z Bank, viyana, 1974-82, Günther Domenig

Figure 8. An example to Expressyonism (3)



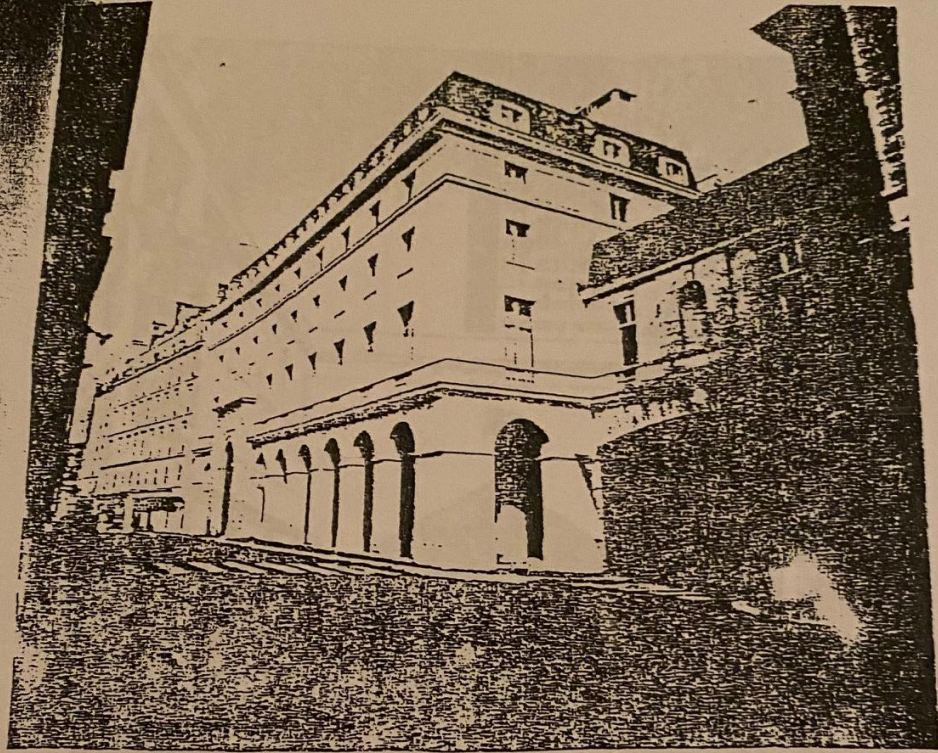
Architectural form components which are used as a means of expression:

- form of additions in the form of masses,
- Form of substructions in the form of masses,
- form of additions in the form of surfaces,
- Form of additions in the form of lines.

ARCHITECTURAL FORM COMPONENTS ARE DOMINANT

Spiral Building, Tokyo, 1984-85, Fumihiko Maki

Figure 9. A Late Modernist example in which geometric property of architectural mass form, form of additions in the form of surfaces and lines are used as a means of expression in order to express technology (3)



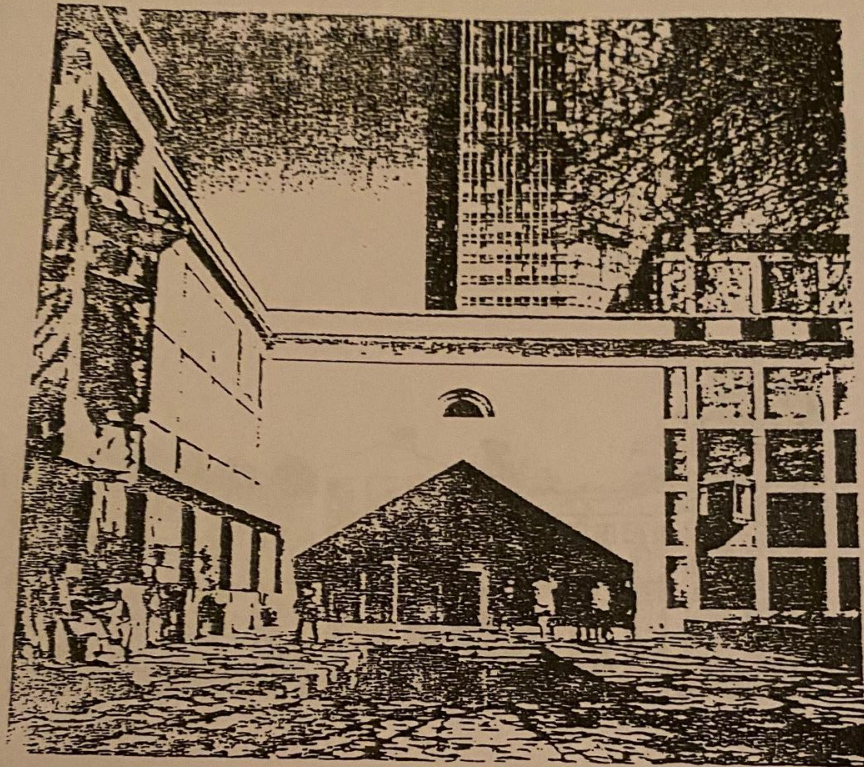
Architectural form components which are used as a means of expression:

- Geometric property of the architectural mass form,
- Form of additions in the form of surfaces,
- Form of additions in the form of lines.

ARCHITECTURAL FORM COMPONENTS ARE DOMINANT

Addition to Senate Building, Paris 1975, Christian Langlois

Şekil 10. Example to a kind of Classicism in which ancient forms are repeated (4)



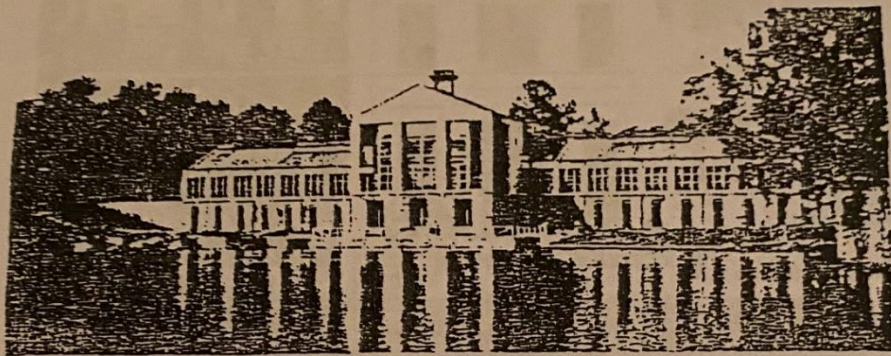
Architectural form components which are used as a means of expression:

- Form of additions in the form of surfaces,
- Form of additions in the form of lines.

ARCHITECTURAL FORM COMPONENTS ARE DOMINANT

Tate Gallery, London, 1982-86, James Stirling, Michael Wilford & Associates

Figure 11. Example to a kind of Classicism in which form of additions in the form of surfaces and lines are used as a means of expression and which is ironical (4)



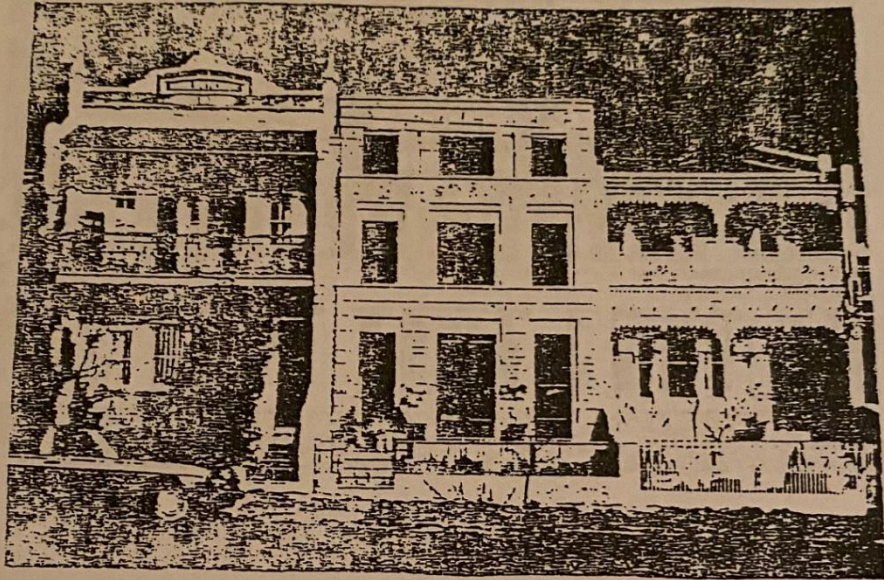
Architectural form components which are used as a means of expression:

- Geometric property of the architectural mass form,
- Form of additions in the form of surfaces,
- Form of additions in the form of lines.

ARCHITECTURAL FORM COMPONENTS ARE DOMINANT

Amvest Headquarters, Virginia, 1985-87, Eisenman Robertson Architects, Trott & Bean Architects

Figure 12. Example to a kind of Classicism for which geometric property of architectural mass form is a means of expression (4)



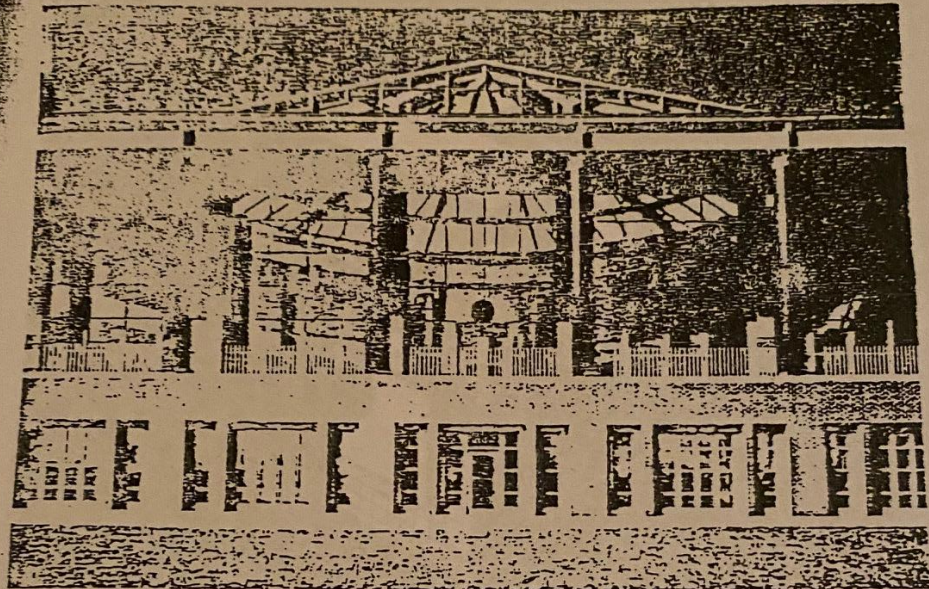
Architectural form components which are used as a means of expression:

- Form of additions in the form of surfaces,
- Form of additions in the form of lines.

**ARCHITECTURAL FORM COMPONENTS ARE DOMINANT**

Henwood House, Sydney, 1985, Alexander Tzannes

Figure 13. Example to a kind of Classicism in which form of additions in the form of surfaces and lines are used as a means of expression and which is monumental (4)



Architectural form components which are used as a means of expression:

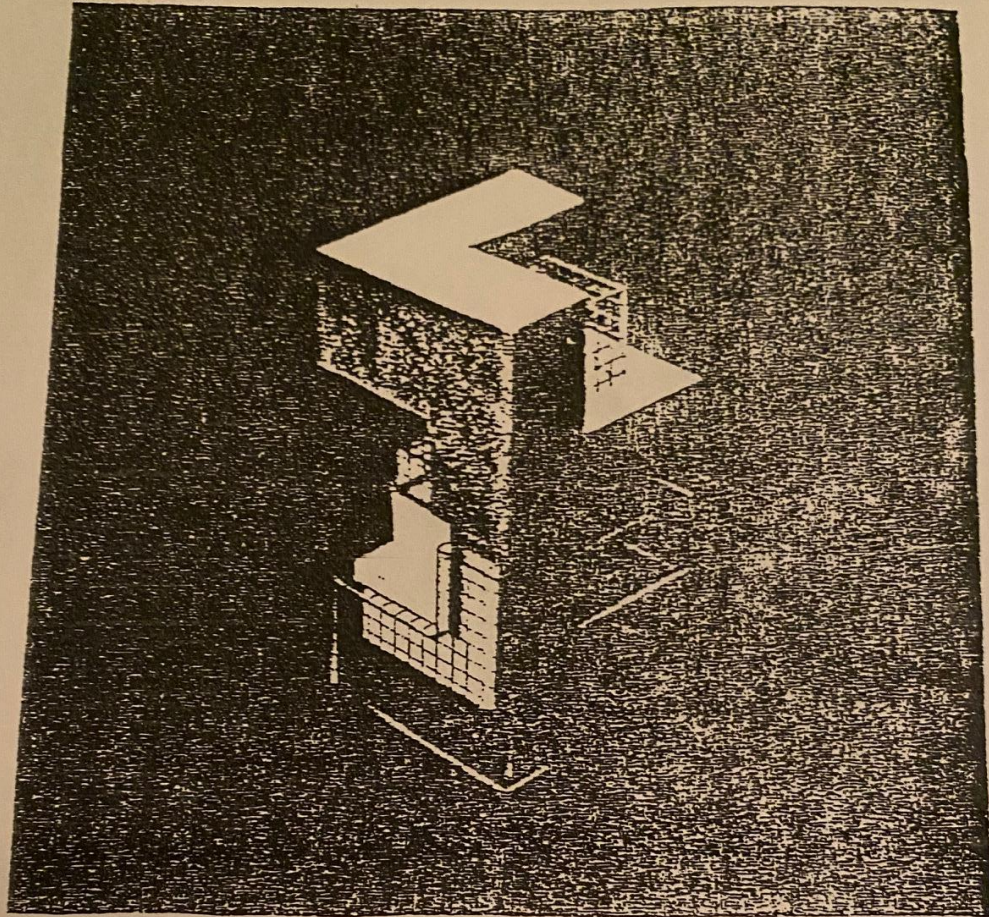
- Geometric property of the architectural mass form,
- Form of structural members,
- Form of structural members,
- Form of additions in the form surfaces,
- form of additions in the form of lines.

ARCHITECTURAL FORM COMPONENTS ARE DOMINANT

American Academy of Pediatrics, Illinois, 1984, Hammond Beeby & Babka

Figure 14. Example to a kind of Classicism in which geometric property of architectural mass form, form of structural members and form of additions in the form of surfaces and lines are used as a means of expression (4)





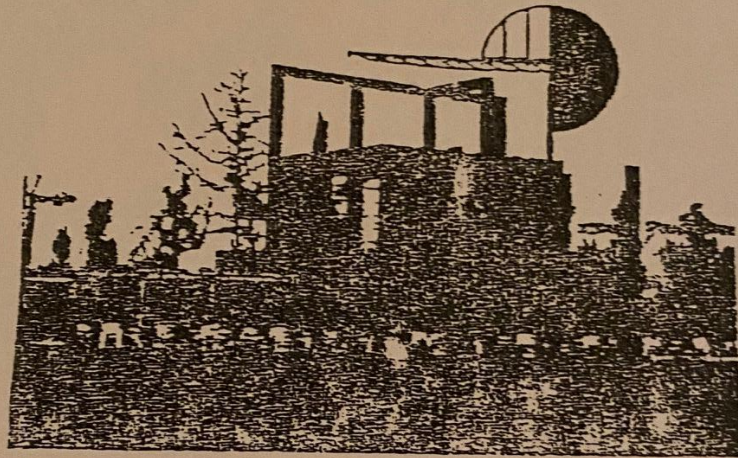
Architectural form components which are used as a means of expression:

- Geometric property of architectural mass form,
- Form of additions in the form of surfaces.

ARCHITECTURAL FORM COMPONENTS ARE DOMINANT

Project for Kurt Forter, 1978-80, Peter Eisenman

Figure 15. Example to Deconstructivism (3)



Architectural form, components which are used as a means of expression:

- Form of additions in the form of masses,
- Form of substructions in the form of masses,
- Form of structural members,
- Form of addition of structural members,
- Form of additions in the form of lines.

ARCHITECTURAL FORM COMPONENTS ARE DOMINANT  
Folie 96, Paris, 1986-87, Bernard Tschumi  
Figure 16. Example to Deconstructivism (3)

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