

W. I. A.

Washington International Airport

A New Concept in Airport Design

by Javier Krasuk

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Virginia Polytechnic Institute and State University in
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MASTER OF ARCHITECTURE

August 1992
Alexandria V.A.

Approved: /

Gregory Hunt

Jaan Holt
Chairman

Dennis Jones



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Washington International Airport

A New Concept in Airport Design

To my parents,
who taught me the values of life.



ACKNOWLEDGEMENT

**To professors Dennis Jones, Jaan Holt and Gregory Hunt
for their unconditional support and thoughtful advice
since the beginning of this project until its conclusion**

Special Thanks

**The National Air and Space Museum
Ridgway's**



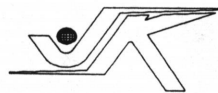
W. I. A.

Washington International Airport

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TABLE OF CONTENTS

| | |
|-------------------|----|
| ABSTRACT | |
| FACULTY COMMENTS | 1 |
| INTRODUCTION | 2 |
| W.I.A. and O.F.S. | 3 |
| PROJECT | 4 |
| VITA | 32 |



ABSTRACT

Washington International Airport

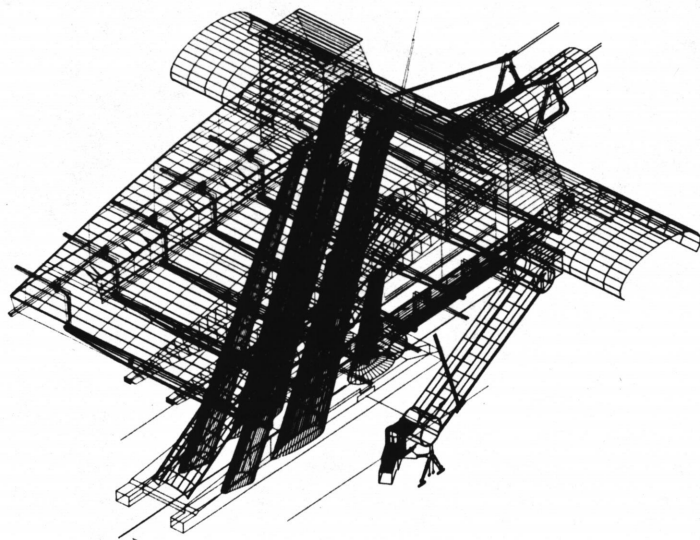
A New Concept in Airport Design

In the past two decades the increase in passengers and frequency of flights has caused commercial air transportation to suffer. The system in current use was designed to satisfy different needs than the contemporary ones. Airports have failed to keep up with increased demands. Movement of passengers and aircraft have not kept pace with advances in technology. Many aircraft arriving and departing simultaneously create unnecessary delays and monetary loss to commercial airlines. The present solutions were based on new additions to existing airports as well as the creation of new airports so that metropolitan flights could arrive to different locations, e.g. JFK, La Guardia and Newark in the New York area; National and Dulles in the Washington D.C. area.

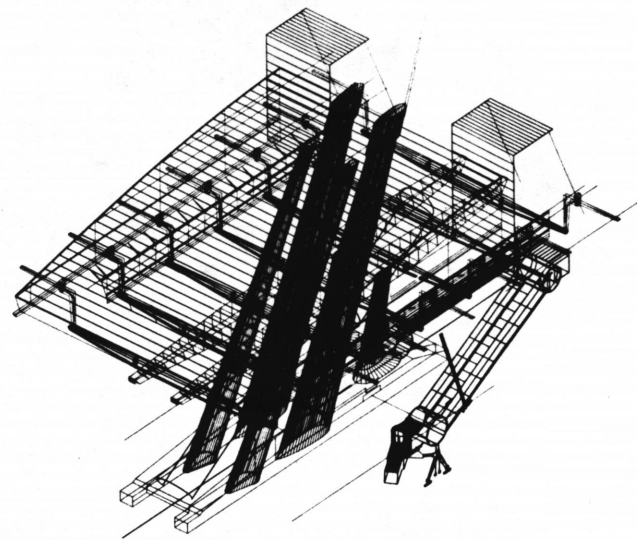
The concept of the traditional airport is obsolete and needs to be completely rethought, not modified.



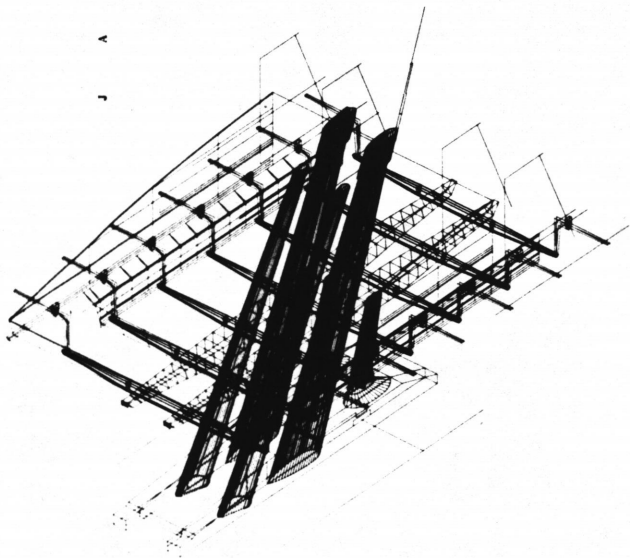
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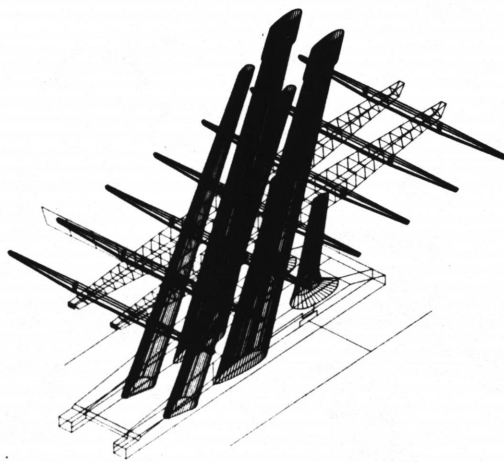
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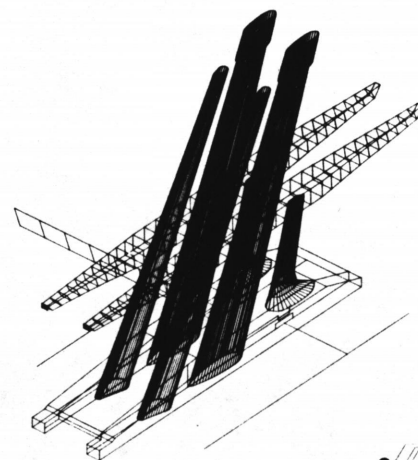
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3 RD



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FIRST



An Architecture of Flight

From man's first upward gaze that glimpsed a bird profiled against a luminous sky, the world of flight has captivated our most fertile imagination. Science and technology have together served this imagination well, as both sky and space have succumbed to the earliest desire to fly. Victories of spirit and invention, our means of flight—from Leonardo da Vinci's remarkable flying apparatus to today's 747s—have been creative testaments to human will—a will that continues to refine, transform, and invent anew.

The design of airports, on the other hand, has not equalled the inventiveness and imagination of the design of the aircraft that are called upon to serve. With few exceptions (Dulles International Airport among them), these designs constitute an "airport architecture" that has produced a remarkably prosaic array of efficiently-planned but generally uninspired works. Conceptually bereft of any larger ideas, these often highly serviceable complexes, used by staggeringly large numbers of passengers and visitors, are but architecturally mute responses to the exhilaration and beauty of the act of flight.

Grounded in extensive research dealing with the movement of people, planes, and goods, the proposed design postulates an innovative circulation system for the planes, multi-level terminals that promise a spatial sequence of architectural richness, and a scale of building that truly recognizes an appropriate reciprocity with the scale of contemporary airplanes.

From its reconsideration of these important aspects of airport design to its mega-structural form language, this project offers us some intriguing new possibilities for an Architecture of Flight.

G.K.H.
August, 1992

Computer-Aided Design

The use of the computer in the design and material allocation of any architectural project will offer a potentially new reality. Because the computer can locate large numbers of points in space coherently and without error or memory faults, it becomes possible to seek shapes and compositions far too difficult to control or build without this tool. This extension of the control scale has already altered flight in new planes, and is altering the very shape of planes possible to fly. The same extended reality will occur in the field of architecture.

An architecture utilizing computer methods will become as easily recognizable and differentiated as the architecture of modern mass production was recognizable from its craft antecedent.

Nevertheless, the necessity of achieving meaningful human significance in an architecturally poetic sense will remain the same.

J.H.
August, 1992

W. I. A.

Washington International Airport

A New Concept in Airport Design

As time goes by, constant changes are required to fulfill the necessities and infrastructures of today's airports. The systems currently used have not changed in their essence since the beginning of Air Commercial Transportation, except in capacity and flight frequencies. The results of these transformations to the system (usually additions) are only producing temporary solutions. In the standard system, aircraft, while in the ground, are dependent on auxiliary ground transportation sub-systems. The double directional taxi line system (DDS), used since the beginning of the air transportation, produces high monetary losses to the air companies which are reflected in fuel expenses and ground delays. When the air traffic of an airport with a conventional DDS system runs under air rush hours, its functionality and efficiency begin to collapse creating unnecessary and unexpected delays. These delays are produced by the density of passengers accumulated in the Main terminals and Gates, and the inefficient and obsolete movement of the aircraft through the bidirectional taxi lines. The airplanes suffer from the implementation of a system where they need to be pulled back by an external ground sub-system that moves the aircraft to the bi-directional taxi lanes where they can finally move on their own. On the other hand, the arriving aircraft need to delay their access to the gates while waiting for the leaving airplanes to reach the main taxi drives, producing conflicts to the flight programs of arrivals, departures and flight connections schedules. All these variables are essential components of a non-efficient system that, if it is not abruptly changed in the upcoming years, with the growing evolution of air traffic, will end up in an air industry collapse.



W. I. A.

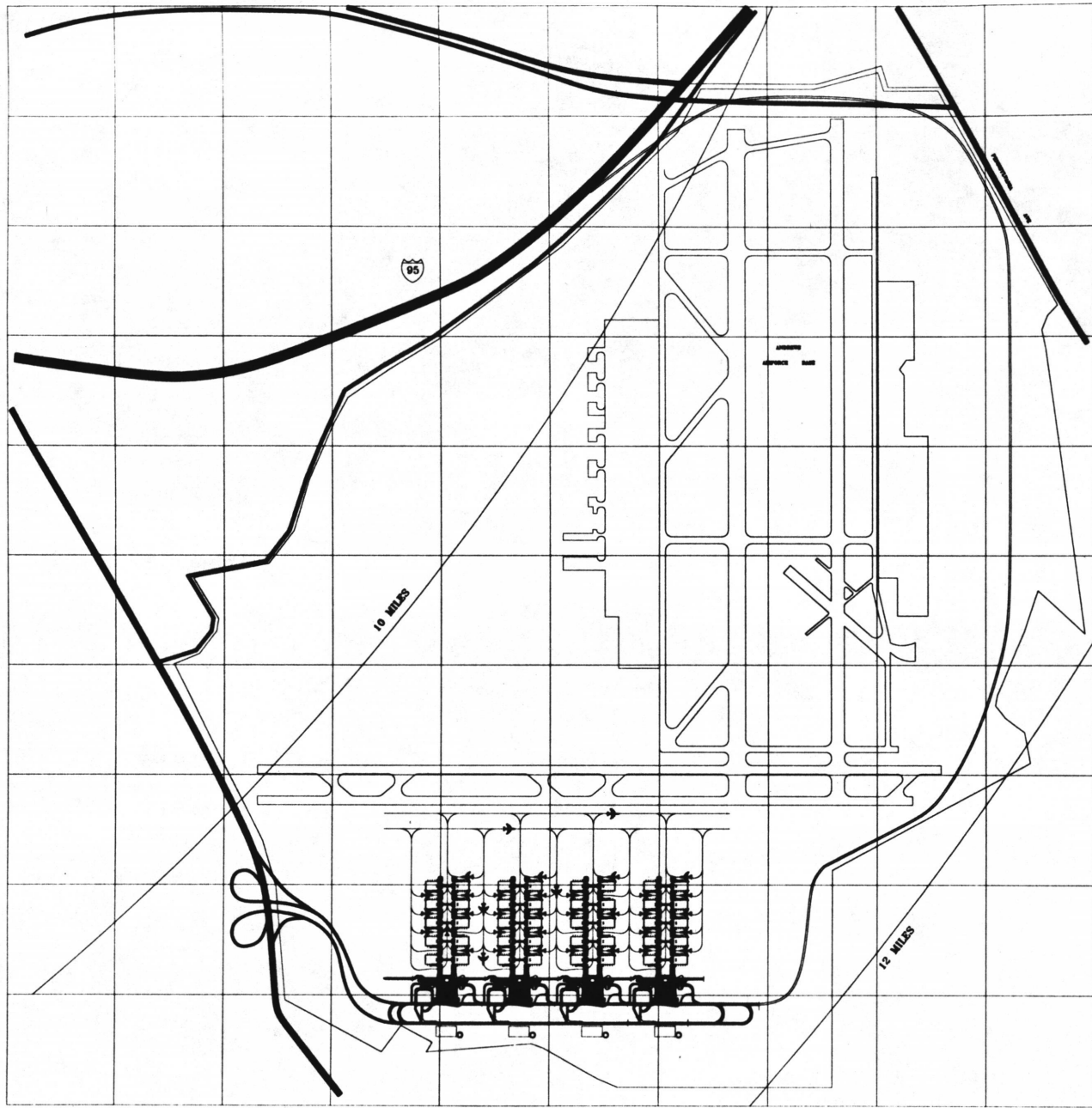
Washington International Airport

A New Concept in Airport Design

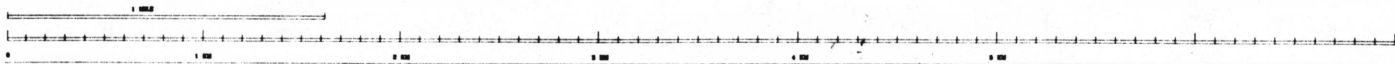
W.I.A. and OFS

W.I.A represents a possible solution to the needs of future airports. The project's site is the present Andrew's Air Force Base. This Military Base is located next to Interstate 95 between Washington D.C. and Baltimore, Md. within a 12 miles radius of the Capitol. This site offers the proper dimensions to install a new International Airport using the innovative OFS (Only Forward System) in replacement of the DDS (Double Directional Taxi lane System) used since the beginning of Commercial Air Transportation. W.I.A. is conceived as a suspended mega structure, where the planes can freely move forward using their own propulsion power, not being restricted by the use of secondary ground sub-systems. The OFS uses a new concept of unidirectional taxi lanes instead of the old and inefficient bidirectional concept. This system allows the planes to reach the gates from the taxi lanes and to leave them without running into unnecessary double-crossing delays. The system is conceived under the standardization of suspended gates, ready to hold planes from a DC9 to a 747-400. The gates were designed with flexible dimensional margins, to accommodate future aircraft under development, such as the Boeing project for a 800 person airplane. W.I.A was designed to hold up to 96 gates with a primary stage of 56 gates. Responding to the functional needs of contemporary airports, the infrastructure was divided into 4 Main Terminals, each one holding up to 12 OFS gates in a primary stage, upgradeable to 96 Gates with the implementation of 4 additional Main Terminals. The OFS Gates are interconnected to each other and to the Main Terminals by linear connectors 29 meters above the ground, leaving 10 additional meters of space between the top of the back wing of a Boeing 747-400 and the connectors base, in order to hold future larger aircraft, like the Boeing previously mentioned. Also the wing separation holds an extra margin of 15 meters on each side, between the wing of the 747-400 and the 6 super columns supporting each of the OFS Gates.



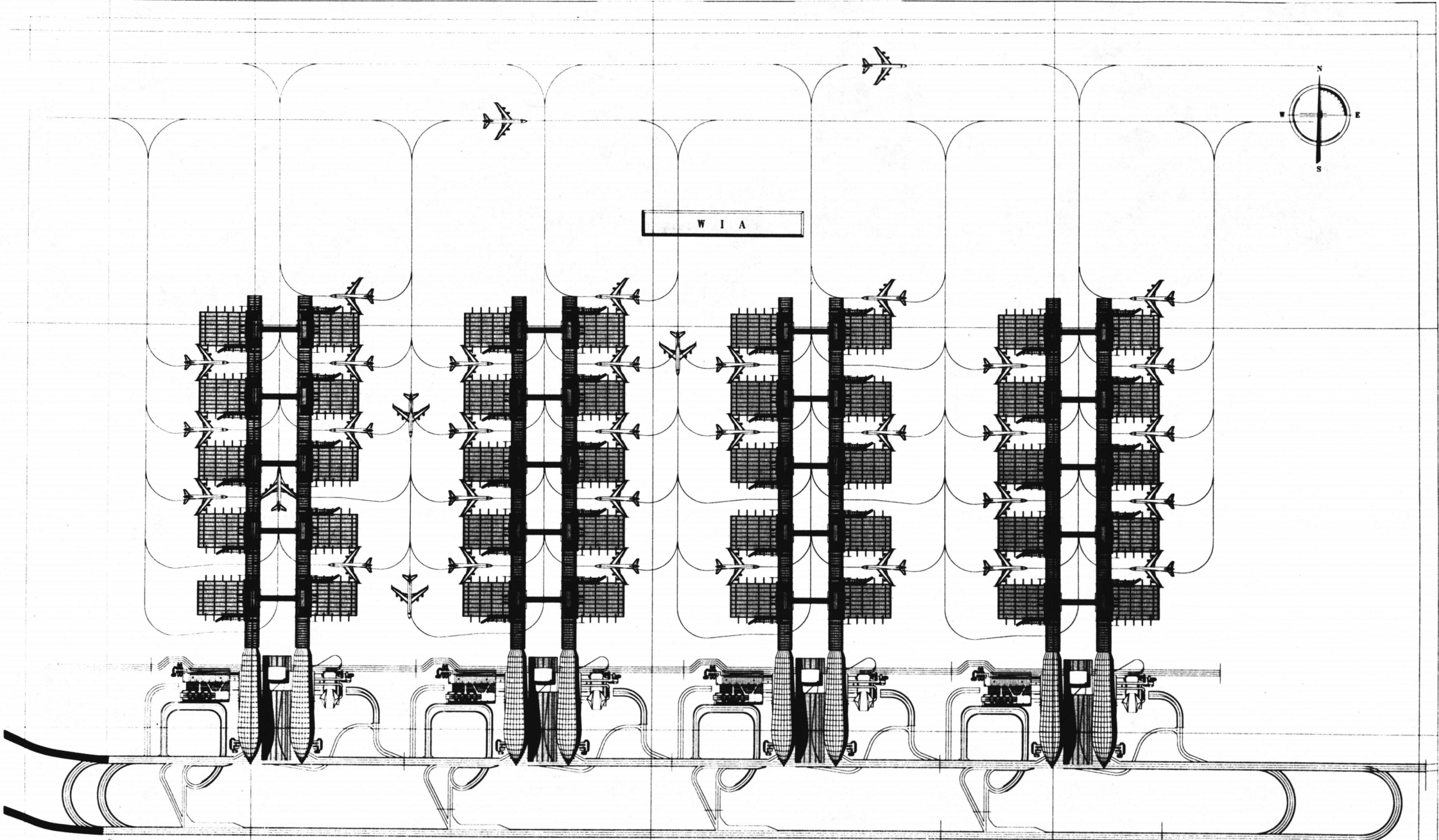


W I A



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| DRAWING NAME: GENERAL PLAN | PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT * PHASE * AIRSIDE | Description: GENERAL PLAN - ACCESS ROAD LATER - INSTALLATION | Reference: 14 CFR / 49 CFR / 14500 / 14501 / 14502 / 14503 / 14504 / 14505 / 14506 / 14507 / 14508 / 14509 / 14510 / 14511 / 14512 / 14513 / 14514 / 14515 / 14516 / 14517 / 14518 / 14519 / 14520 / 14521 / 14522 / 14523 / 14524 / 14525 / 14526 / 14527 / 14528 / 14529 / 14530 / 14531 / 14532 / 14533 / 14534 / 14535 / 14536 / 14537 / 14538 / 14539 / 14540 / 14541 / 14542 / 14543 / 14544 / 14545 / 14546 / 14547 / 14548 / 14549 / 14550 / 14551 / 14552 / 14553 / 14554 / 14555 / 14556 / 14557 / 14558 / 14559 / 14560 / 14561 / 14562 / 14563 / 14564 / 14565 / 14566 / 14567 / 14568 / 14569 / 14570 / 14571 / 14572 / 14573 / 14574 / 14575 / 14576 / 14577 / 14578 / 14579 / 14580 / 14581 / 14582 / 14583 / 14584 / 14585 / 14586 / 14587 / 14588 / 14589 / 14590 / 14591 / 14592 / 14593 / 14594 / 14595 / 14596 / 14597 / 14598 / 14599 / 14600 / 14601 / 14602 / 14603 / 14604 / 14605 / 14606 / 14607 / 14608 / 14609 / 14610 / 14611 / 14612 / 14613 / 14614 / 14615 / 14616 / 14617 / 14618 / 14619 / 14620 / 14621 / 14622 / 14623 / 14624 / 14625 / 14626 / 14627 / 14628 / 14629 / 14630 / 14631 / 14632 / 14633 / 14634 / 14635 / 14636 / 14637 / 14638 / 14639 / 14640 / 14641 / 14642 / 14643 / 14644 / 14645 / 14646 / 14647 / 14648 / 14649 / 14650 / 14651 / 14652 / 14653 / 14654 / 14655 / 14656 / 14657 / 14658 / 14659 / 14660 / 14661 / 14662 / 14663 / 14664 / 14665 / 14666 / 14667 / 14668 / 14669 / 14670 / 14671 / 14672 / 14673 / 14674 / 14675 / 14676 / 14677 / 14678 / 14679 / 14680 / 14681 / 14682 / 14683 / 14684 / 14685 / 14686 / 14687 / 14688 / 14689 / 14690 / 14691 / 14692 / 14693 / 14694 / 14695 / 14696 / 14697 / 14698 / 14699 / 14700 / 14701 / 14702 / 14703 / 14704 / 14705 / 14706 / 14707 / 14708 / 14709 / 14710 / 14711 / 14712 / 14713 / 14714 / 14715 / 14716 / 14717 / 14718 / 14719 / 14720 / 14721 / 14722 / 14723 / 14724 / 14725 / 14726 / 14727 / 14728 / 14729 / 14730 / 14731 / 14732 / 14733 / 14734 / 14735 / 14736 / 14737 / 14738 / 14739 / 14740 / 14741 / 14742 / 14743 / 14744 / 14745 / 14746 / 14747 / 14748 / 14749 / 14750 / 14751 / 14752 / 14753 / 14754 / 14755 / 14756 / 14757 / 14758 / 14759 / 14760 / 14761 / 14762 / 14763 / 14764 / 14765 / 14766 / 14767 / 14768 / 14769 / 14770 / 14771 / 14772 / 14773 / 14774 / 14775 / 14776 / 14777 / 14778 / 14779 / 14780 / 14781 / 14782 / 14783 / 14784 / 14785 / 14786 / 14787 / 14788 / 14789 / 14790 / 14791 / 14792 / 14793 / 14794 / 14795 / 14796 / 14797 / 14798 / 14799 / 14800 / 14801 / 14802 / 14803 / 14804 / 14805 / 14806 / 14807 / 14808 / 14809 / 14810 / 14811 / 14812 / 14813 / 14814 / 14815 / 14816 / 14817 / 14818 / 14819 / 14820 / 14821 / 14822 / 14823 / 14824 / 14825 / 14826 / 14827 / 14828 / 14829 / 14830 / 14831 / 14832 / 14833 / 14834 / 14835 / 14836 / 14837 / 14838 / 14839 / 14840 / 14841 / 14842 / 14843 / 14844 / 14845 / 14846 / 14847 / 14848 / 14849 / 14850 / 14851 / 14852 / 14853 / 14854 / 14855 / 14856 / 14857 / 14858 / 14859 / 14860 / 14861 / 14862 / 14863 / 14864 / 14865 / 14866 / 14867 / 14868 / 14869 / 14870 / 14871 / 14872 / 14873 / 14874 / 14875 / 14876 / 14877 / 14878 / 14879 / 14880 / 14881 / 14882 / 14883 / 14884 / 14885 / 14886 / 14887 / 14888 / 14889 / 14890 / 14891 / 14892 / 14893 / 14894 / 14895 / 14896 / 14897 / 14898 / 14899 / 14900 / 14901 / 14902 / 14903 / 14904 / 14905 / 14906 / 14907 / 14908 / 14909 / 14910 / 14911 / 14912 / 14913 / 14914 / 14915 / 14916 / 14917 / 14918 / 14919 / 14920 / 14921 / 14922 / 14923 / 14924 / 14925 / 14926 / 14927 / 14928 / 14929 / 14930 / 14931 / 14932 / 14933 / 14934 / 14935 / 14936 / 14937 / 14938 / 14939 / 14940 / 14941 / 14942 / 14943 / 14944 / 14945 / 14946 / 14947 / 14948 / 14949 / 14950 / 14951 / 14952 / 14953 / 14954 / 14955 / 14956 / 14957 / 14958 / 14959 / 14960 / 14961 / 14962 / 14963 / 14964 / 14965 / 14966 / 14967 / 14968 / 14969 / 14970 / 14971 / 14972 / 14973 / 14974 / 14975 / 14976 / 14977 / 14978 / 14979 / 14980 / 14981 / 14982 / 14983 / 14984 / 14985 / 14986 / 14987 / 14988 / 14989 / 14990 / 14991 / 14992 / 14993 / 14994 / 14995 / 14996 / 14997 / 14998 / 14999 / 15000 | Notes: SEE PLAN DOCUMENTATION | Symbology: NONE | Drawing Units: master metric | SCALE: F A A |
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 DRAWING FILE: P152N

PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT
 Description: GENERAL PLAN - ACCESS ROAD LINES - INSTALLATIONS

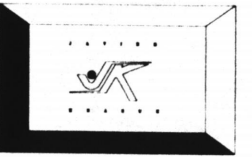
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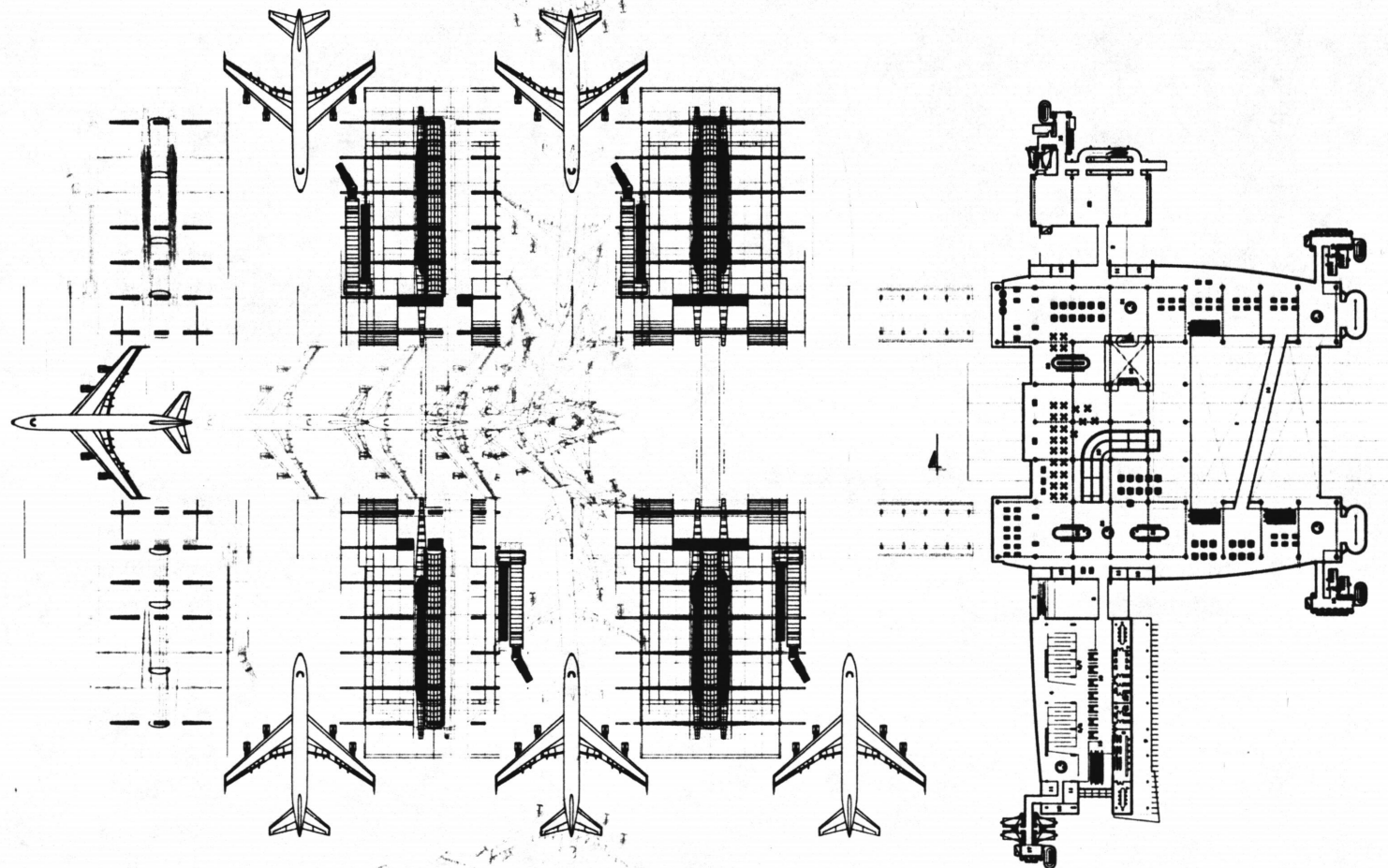
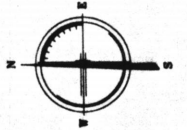
Notes: SEE PLAN DOCUMENTATION

Symbology: NONE

Drawing Units: master metric

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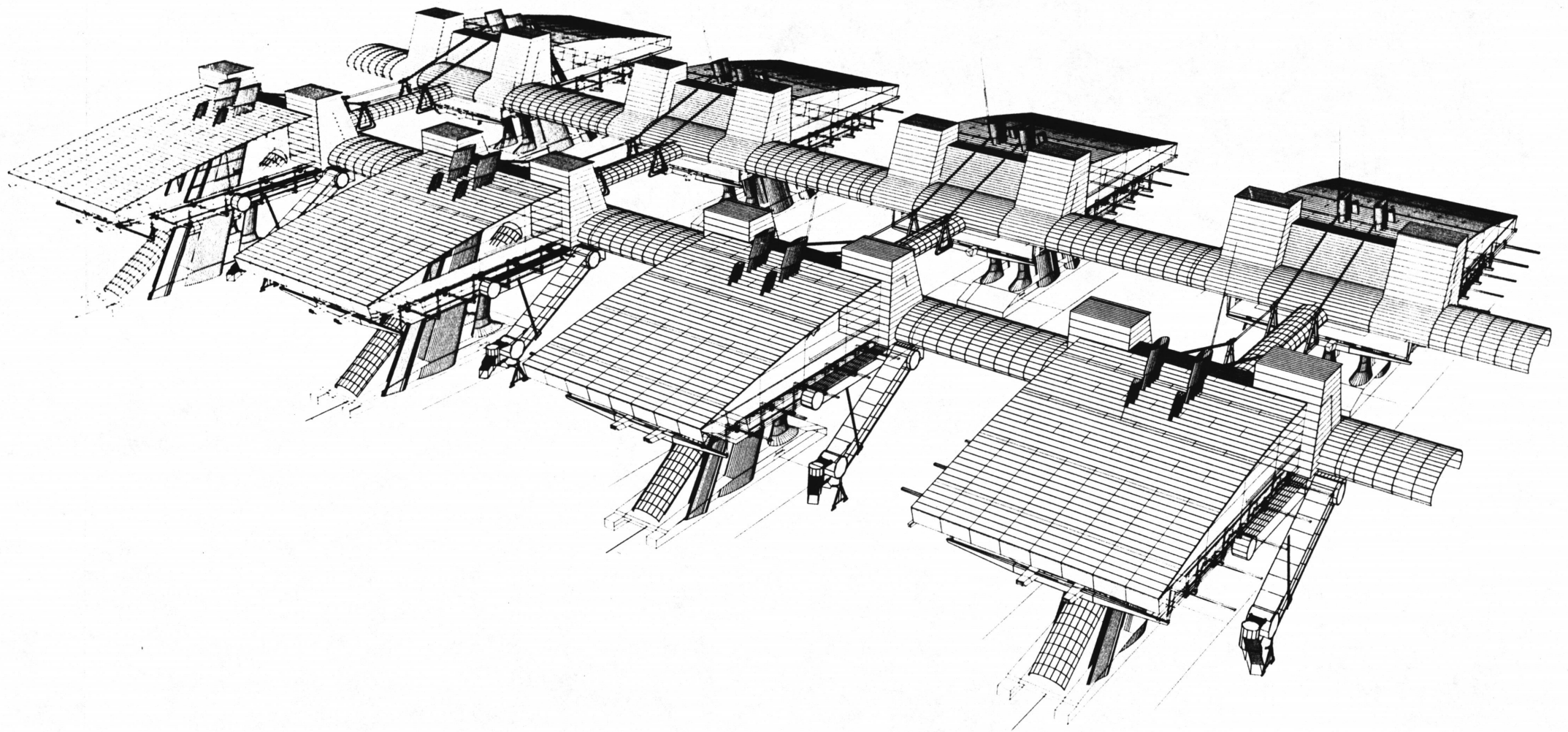


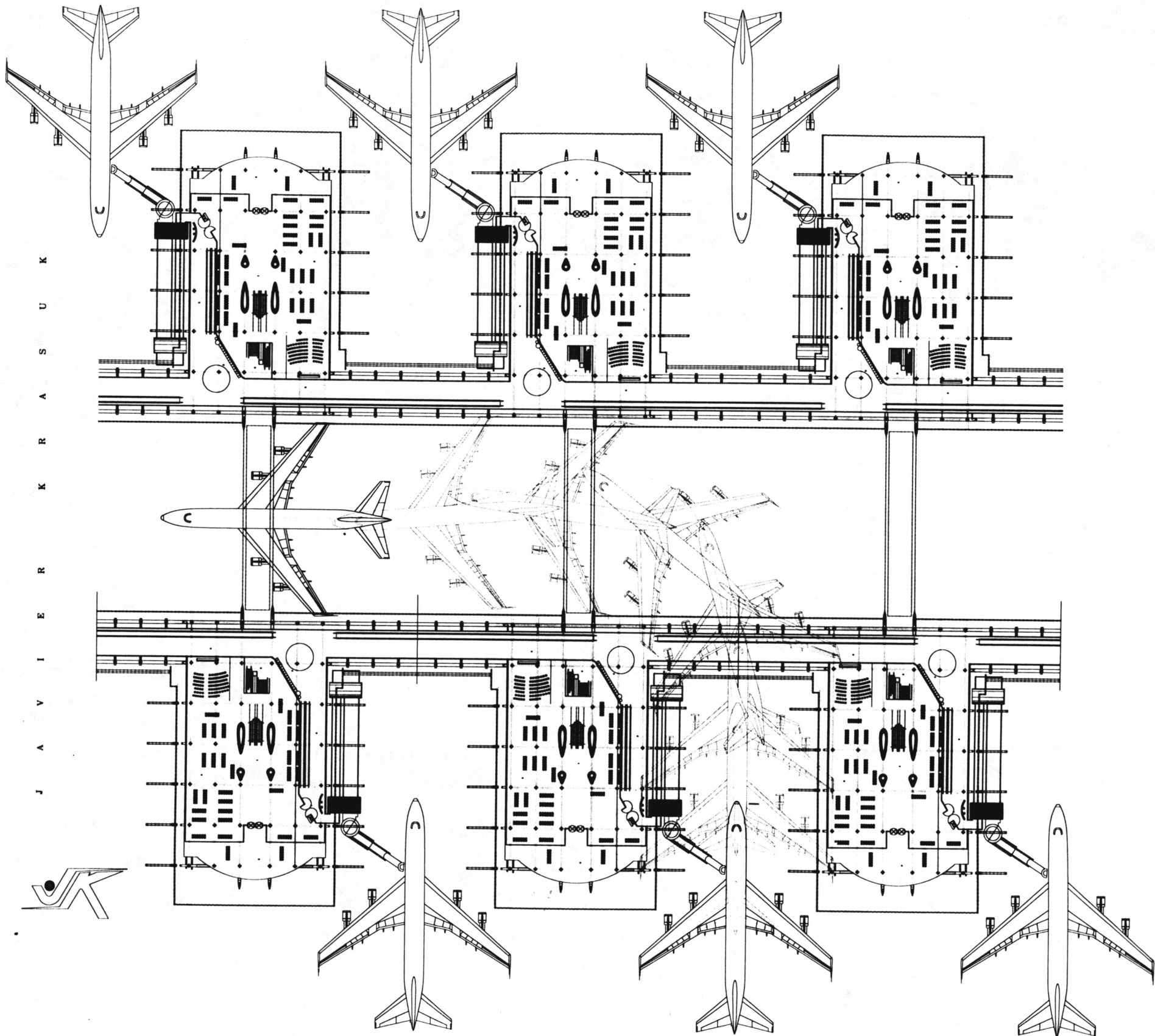


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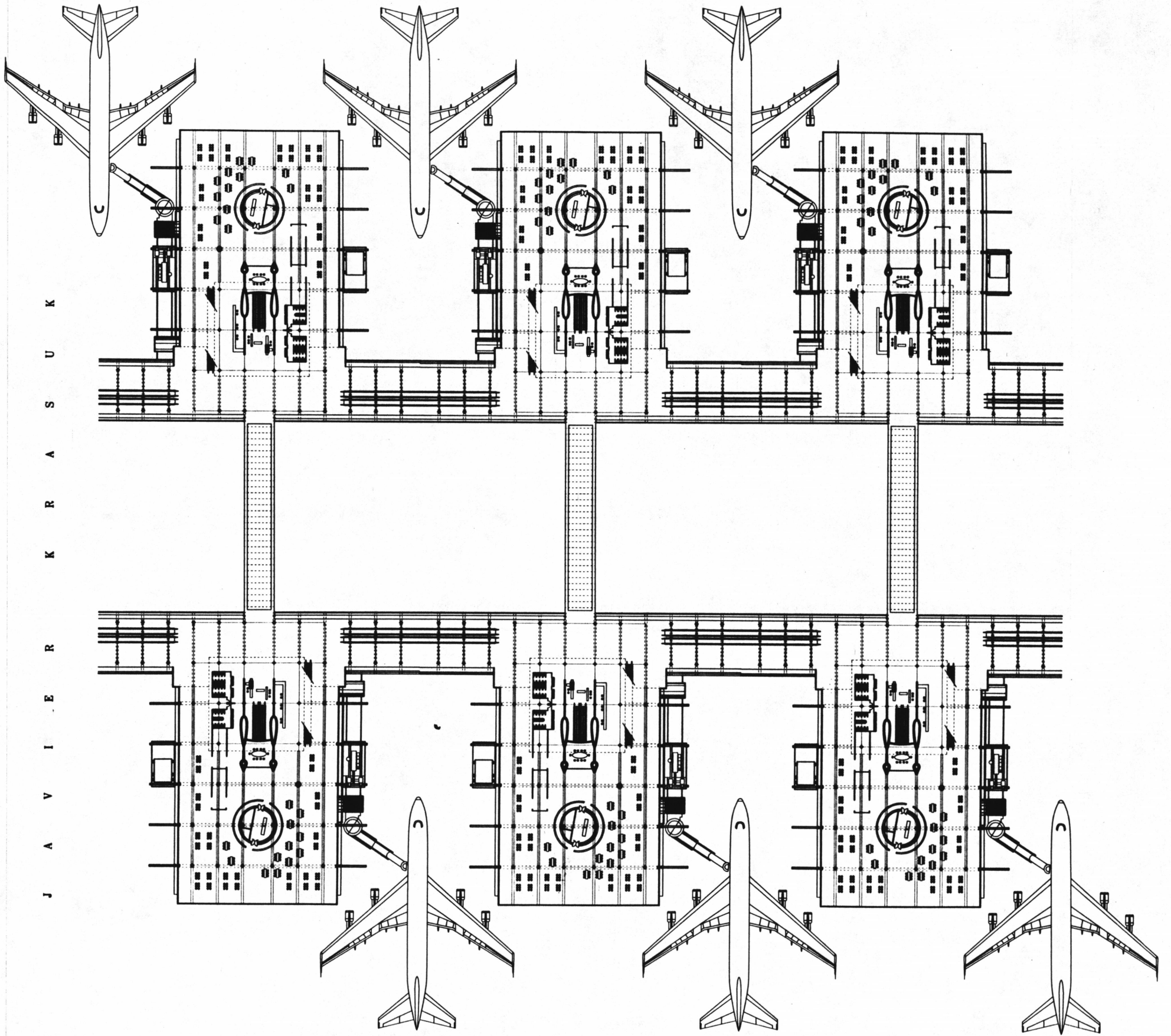
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| DRAWING NAME: 2nd LEVEL PLAN PHO | PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT CONSTRUCTION PROGRAM | Description: 2ND LEVEL MAIN GATES PROPERTY 1 - Gates | Reference: to file: 8/ 876/ 1488/ 1489/ 1490/ 1491/ 1492/ 1493/ 1494/ 1495/ 1496/ 1497/ 1498/ 1499/ | Notes: SEE 1ST FLY - GROUND AIRPLANE MOVEMENT | Symbology: NONE | Drawing Units: master metric | SCALE: F A A |
| DRAWING FILE: 0248P | | | | | | | |



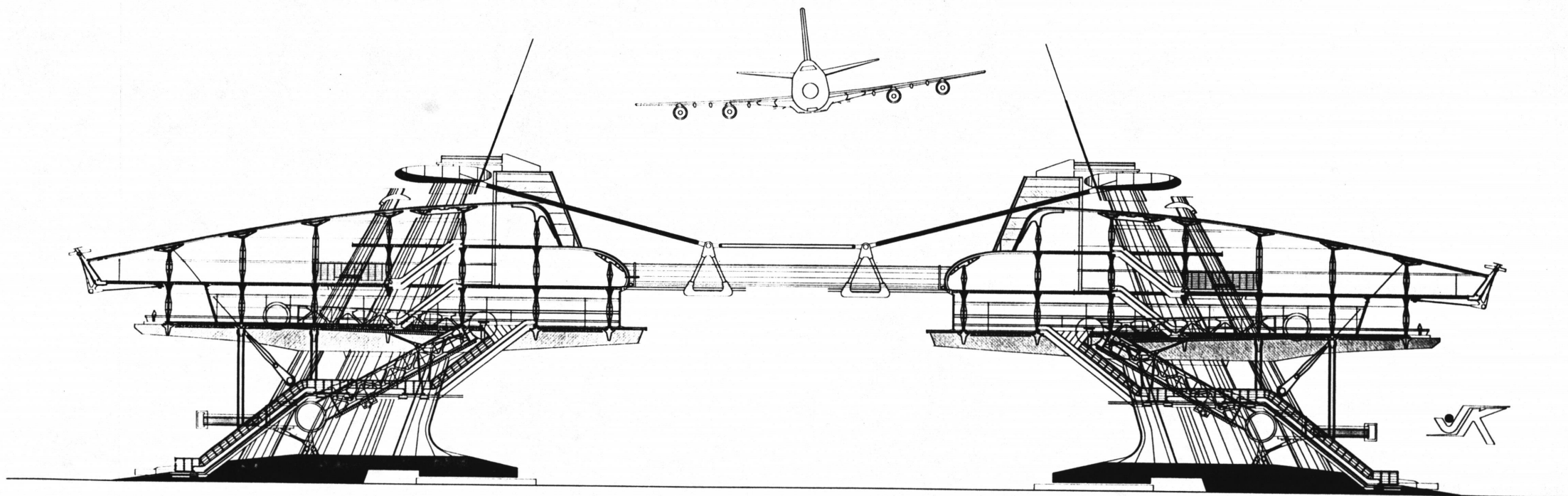




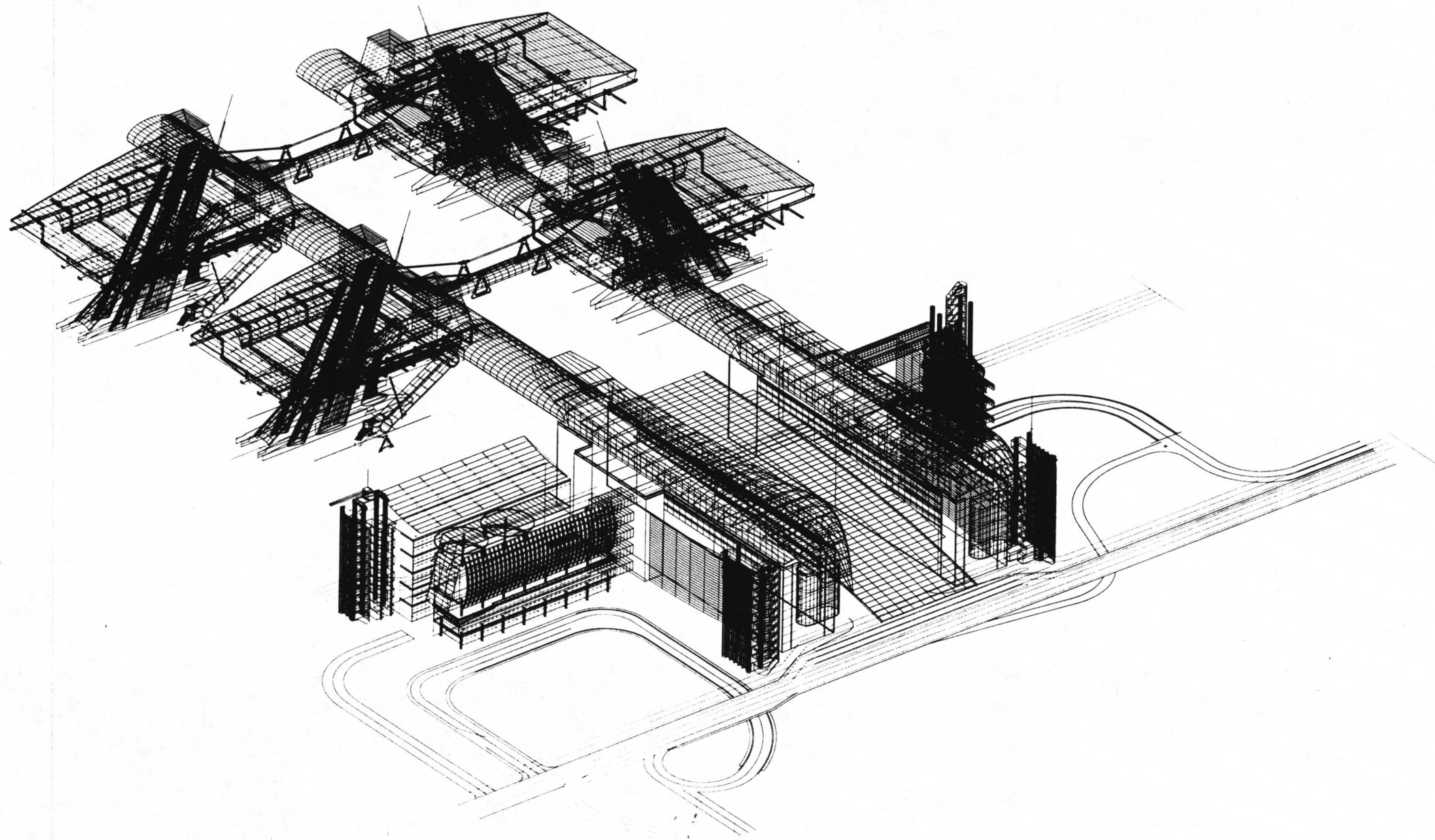
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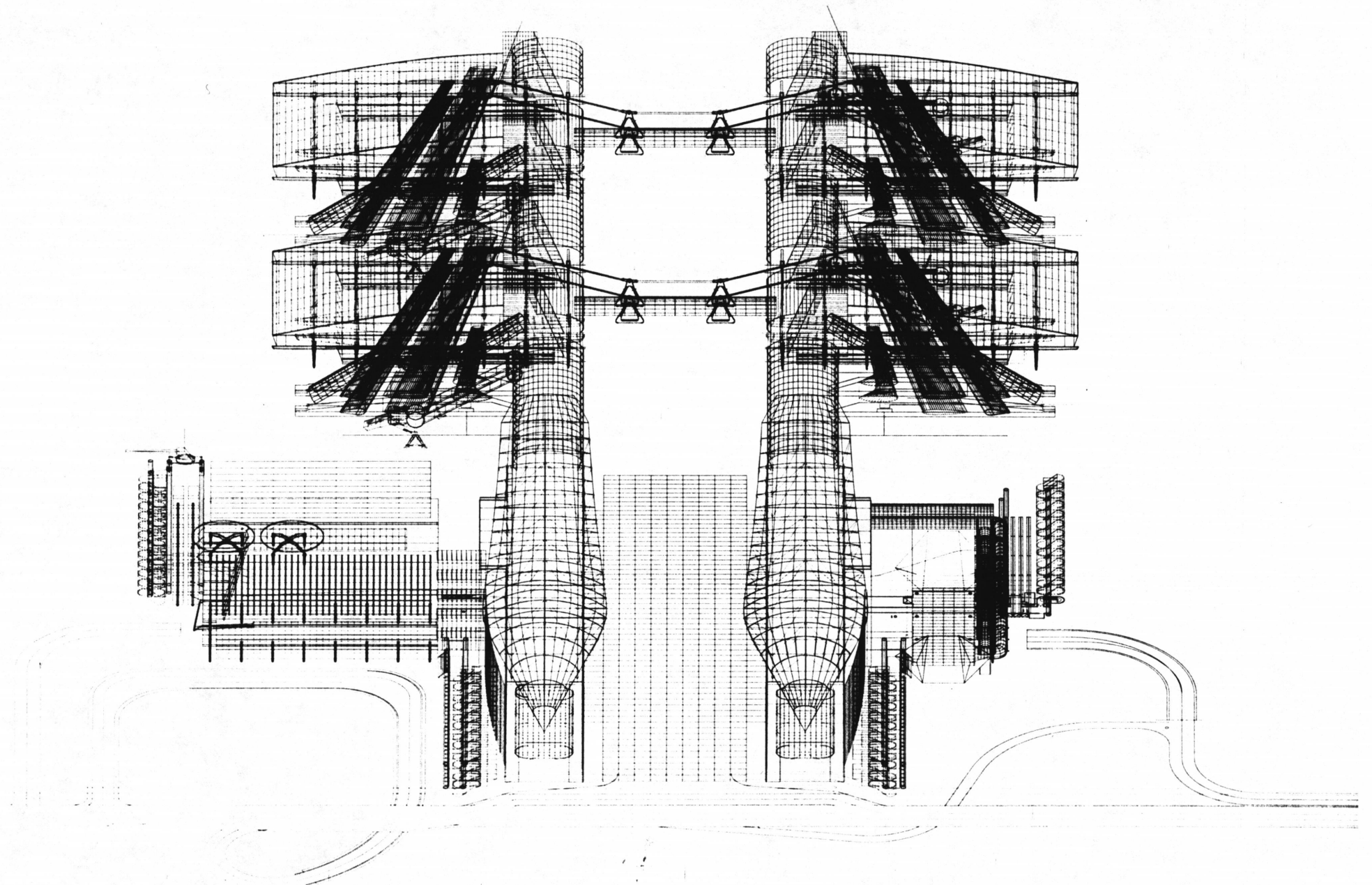


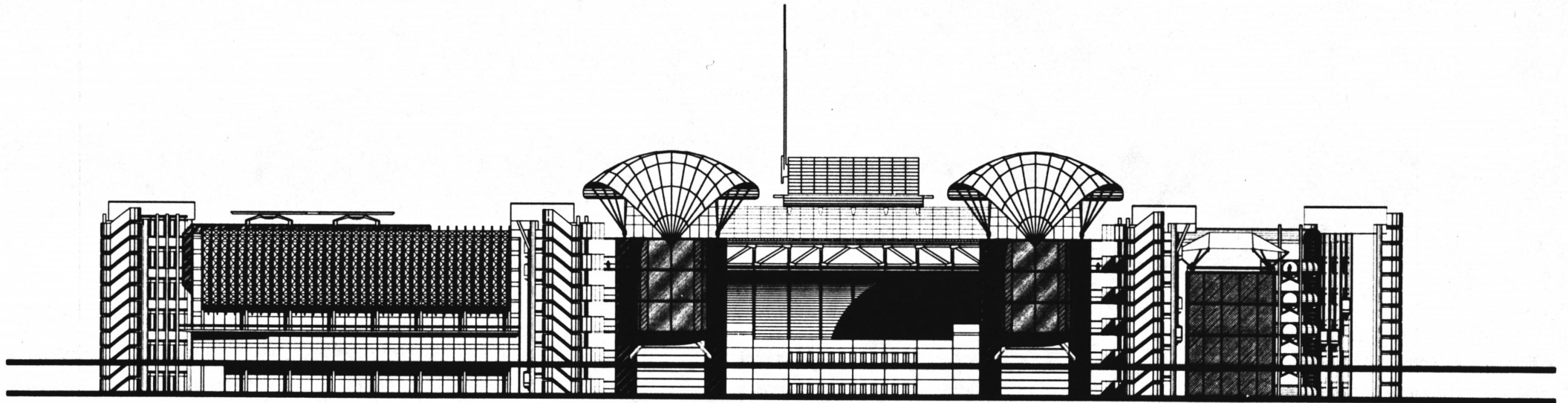
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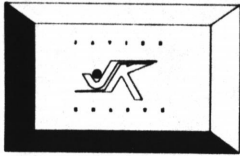


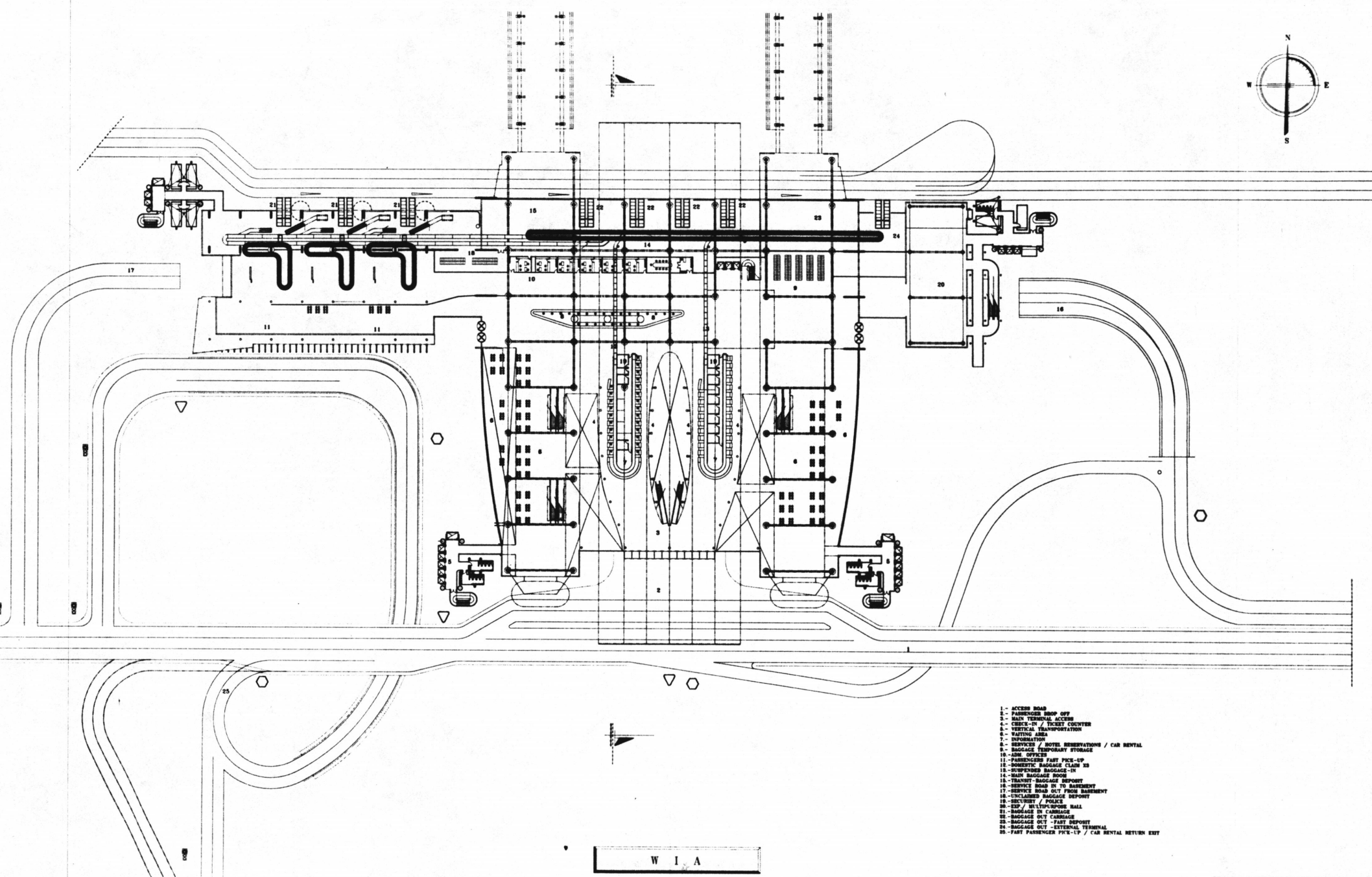




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| DRAWING NAME: FRONT SIDE VIEW | PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT a name drawing file | Description: Front side view of this Terminal prototype | Reference: to file: 01/001/1000/0000/0000/ 0000/0000/0000/0000/ 0000/0000/ | Notes: This drawing is a master drawing / not for construction / not for construction / not for construction / | Symbology: none | Drawing Units: master metric | SCALE: 1:320 FAA |
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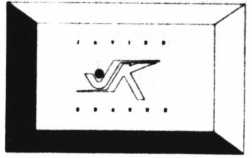


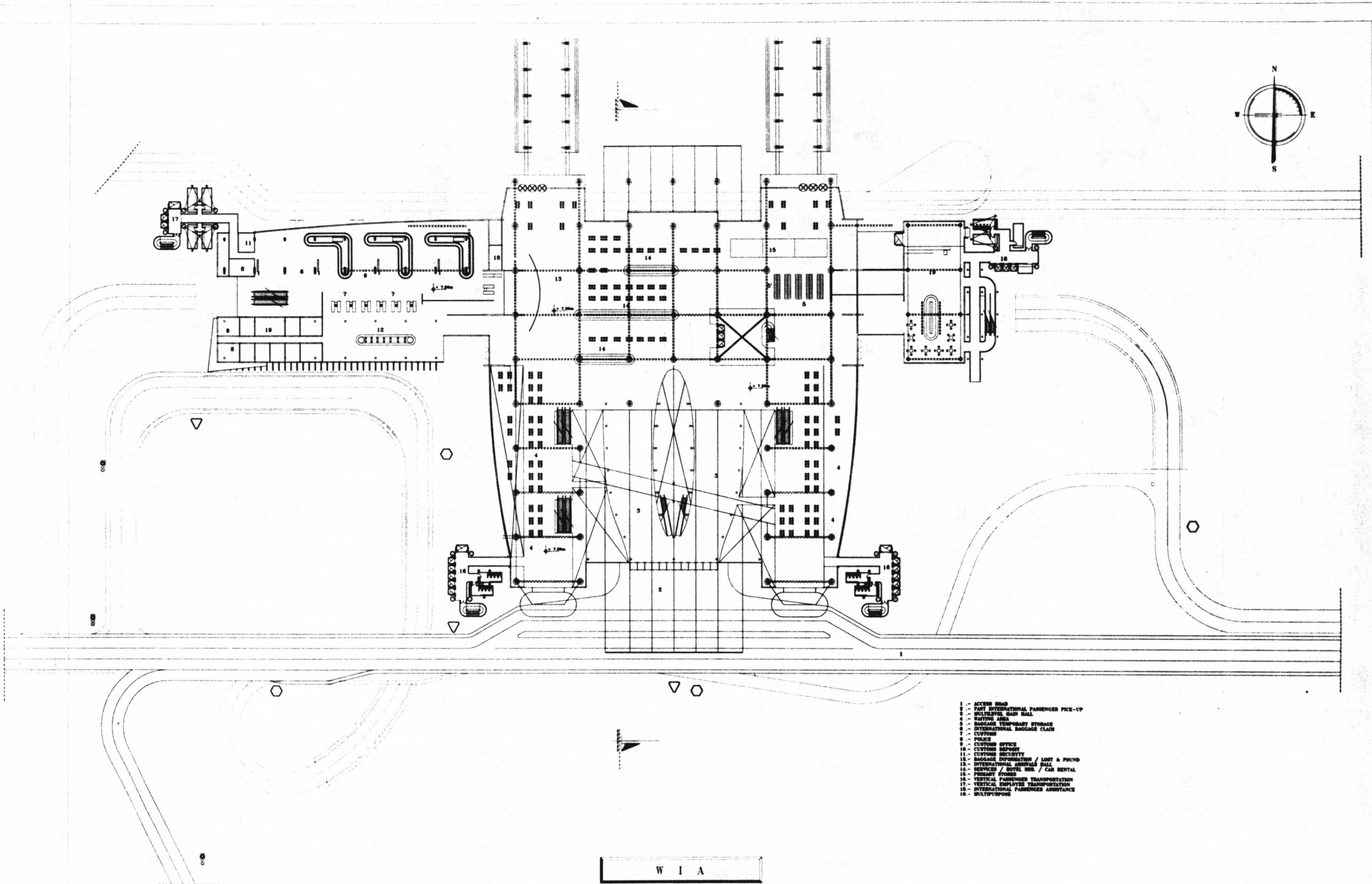


- 1.- ACCESS ROAD
- 2.- PASSENGER DROP OFF
- 3.- MAIN TERMINAL ACCESS
- 4.- CHECK-IN / TICKET CENTER
- 5.- VERTICAL TRANSPORTATION
- 6.- WAITING AREA
- 7.- INFORMATION
- 8.- SERVICES / HOTEL RESERVATIONS / CAR RENTAL
- 9.- BAGGAGE TEMPORARY STORAGE
- 10.- JMW OFFICE
- 11.- PASSENGERS FAST PICK-UP
- 12.- BOMBIC BAGGAGE CLAIM RD
- 13.- SUSPENDED BAGGAGE-IN
- 14.- MAIN BAGGAGE ROOM
- 15.- TRANSIT BAGGAGE DEPOSIT
- 16.- SERVICE ROAD IN TO BASEMENT
- 17.- SERVICE ROAD OUT FROM BASEMENT
- 18.- UNCLAIMED BAGGAGE DEPOSIT
- 19.- SECURITY / POLICE
- 20.- EXP / NEWSPAPER HALL
- 21.- BAGGAGE IN CARRIAGE
- 22.- BAGGAGE OUT CARRIAGE
- 23.- BAGGAGE OUT - FAST DEPOSIT
- 24.- BAGGAGE OUT - EXTERNAL TERMINAL
- 25.- FAST PASSENGER PICK-UP / CAR RENTAL RETURN EXIT

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|---|--|--|--|---|---|--|--------------------------|
| DRAWING NAME: GROUND FLOOR PLAN | PROJECT NAME: WASHINGTON INTERNATIONAL AIRPORT | Description: Main terminal ground level plan PROTOTYPE 1 - screen | Reference: to files: 02/007/04007/04007/04007/ 01002/01007/ | Notes: 1.7 Plan with screen made - check in subject Bomber flight bagage Baggage transportation 10/1 floor plan Passenger fast pick up Passenger fast pick up | Symbology: Direction light stop yield | Drawing Units: master metric | SCALE: 1 : 400 |
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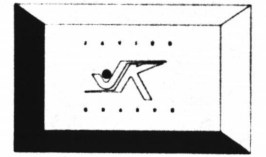


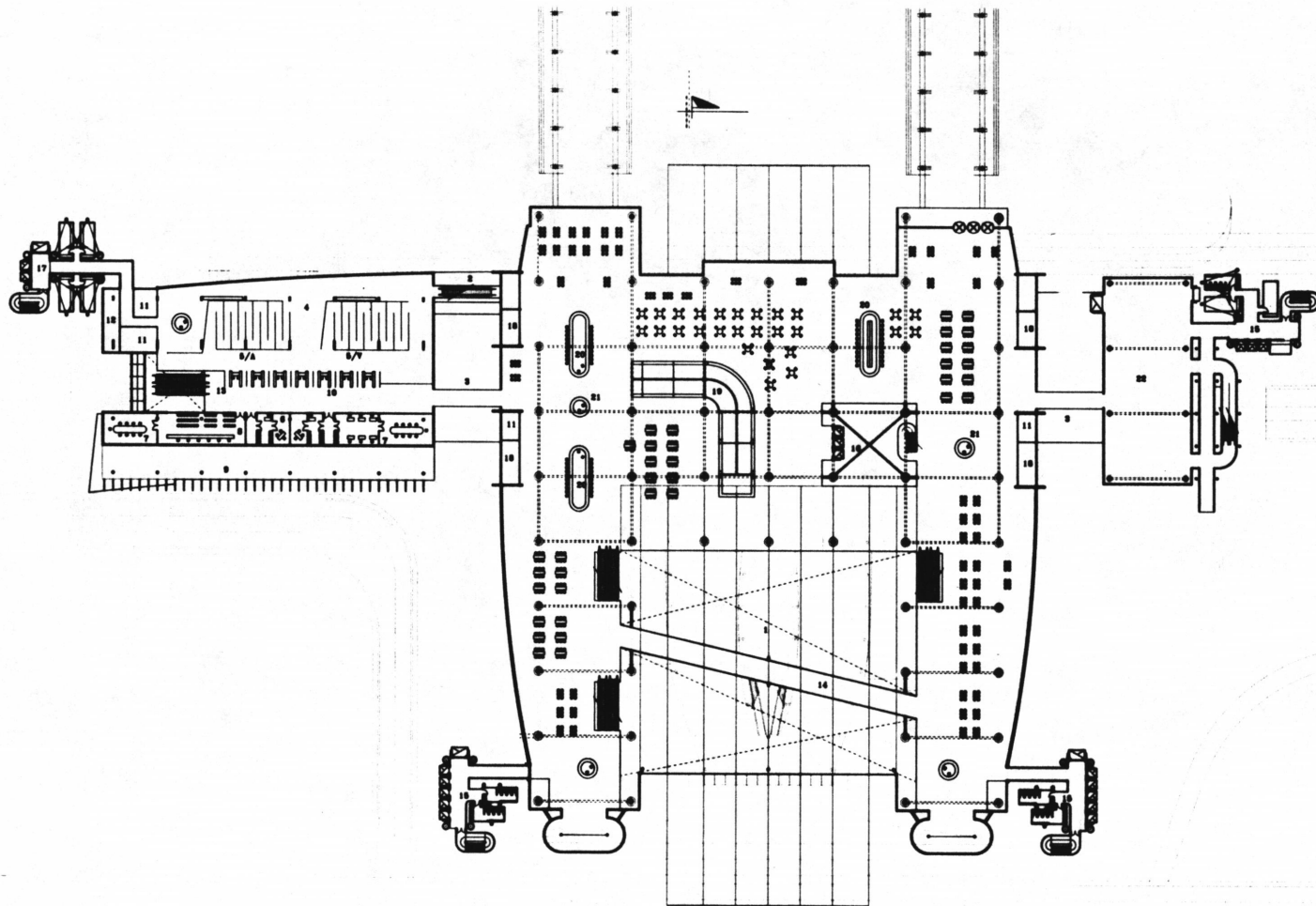


- 1 - ACCESS ROAD
- 2 - FIRST INTERNATIONAL PASSENGER PICK-UP
- 3 - WAITING AREA
- 4 - WAITING AREA
- 5 - BAGGAGE TEMPORARY STORAGE
- 6 - INTERNATIONAL BAGGAGE CLAIM
- 7 - CUSTOMS
- 8 - POLICE
- 9 - CUSTOMS OFFICE
- 10 - CUSTOMS INSPECTION
- 11 - CUSTOMS SECURITY
- 12 - BAGGAGE INFORMATION / LOST & FOUND
- 13 - INTERNATIONAL AIRMAIL HALL
- 14 - SERVICE / HOTEL RES. / CAR RENTAL
- 15 - FEDERAL / TOWER
- 16 - FEDERAL PASSENGER TRANSPORTATION
- 17 - FEDERAL EMPLOYEES TRANSPORTATION
- 18 - INTERNATIONAL PASSENGER ASSISTANCE
- 19 - MULTIPURPOSE

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| DRAWING NAME: | 2ND LEVEL | PROJECT NAME: | WASHINGTON INTERNATIONAL AIRPORT | Description: | Main Terminal 2nd level | Reference: | 14.000.00 / SITE / PDRY / EXHIB / 100000 / 100000 / 100000 | Notes: | 2nd LEVEL PLAN with screen roads + customs International Flight Baggage claim International Passenger Services International Passenger Transport Support Transportation Terminal to Terminal | Symbology: | Reference Ground floor plan | Drawing: | master | Units: | metric | SCALE 1 : 400 |
| DRAWING FILE: | 15THF | | | | | | | | | | | | | | | |

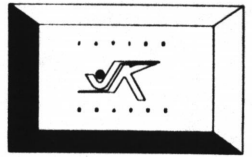


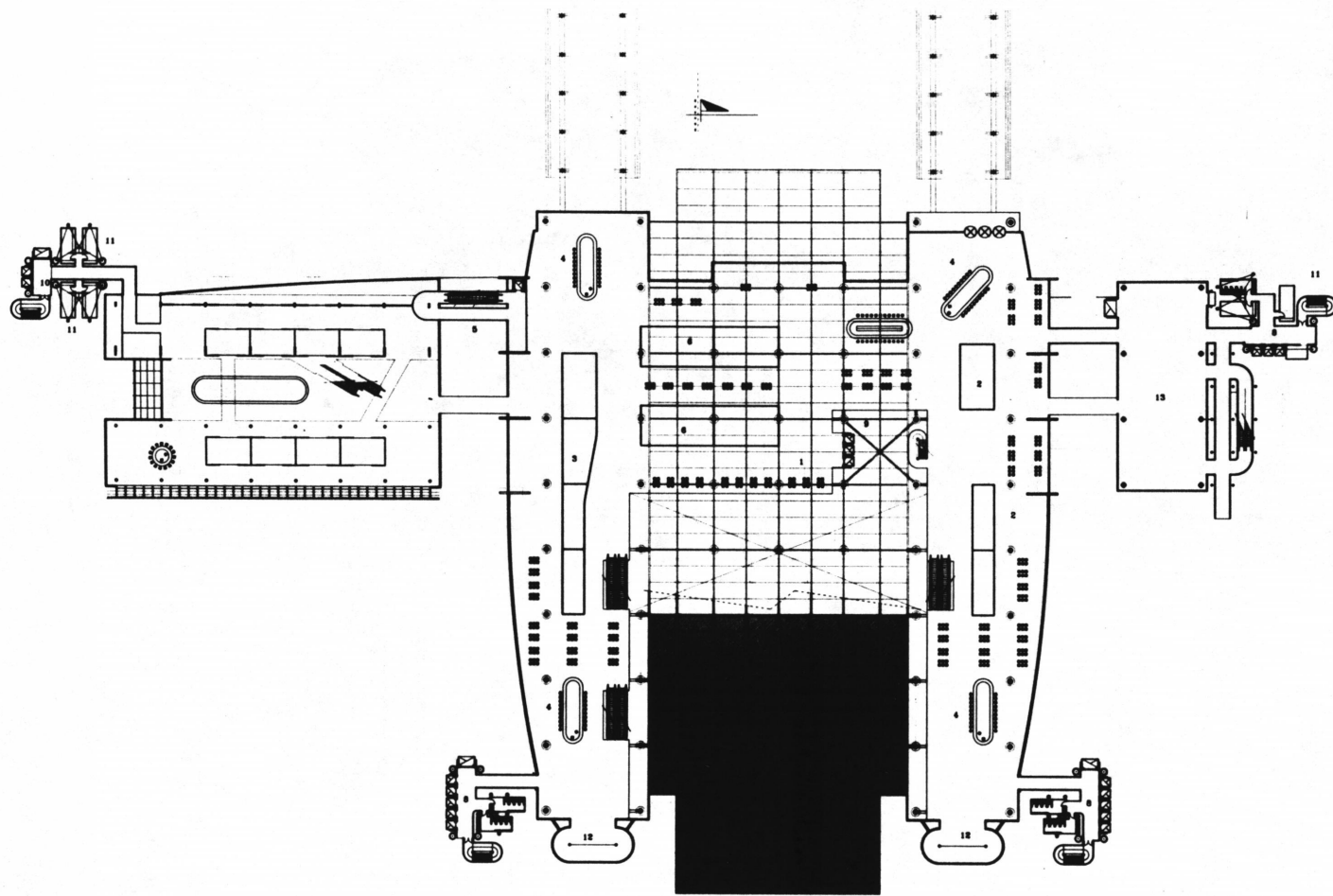


- 1 - MULTILEVEL MAIN HALL / FOOD COURT
- 2 - 20 SEPARATE FINE CLAYS
- 3 - CONDUCTIVE MAIN HALL
- 4 - CONDUCTIVE MAIN HALL
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| DRAWING NAME: | 2nd LEVEL PLUMB PLAN | PROJECT NAME: | Description: | Reference: | Notes: | Symbology | Drawing Units | SCALE |
| DRAWING FILE: | 2nd | OPERATIONAL | 2nd Level | 1/1000 / 1/500 / 1/250 / 1/125 / 1/62.5 / 1/31.25 / 1/15.625 / 1/7.8125 / 1/3.90625 | Operational - 2nd Level | 1/1000 / 1/500 / 1/250 / 1/125 / 1/62.5 / 1/31.25 / 1/15.625 / 1/7.8125 / 1/3.90625 | metric | 1 : 400 |

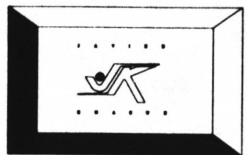


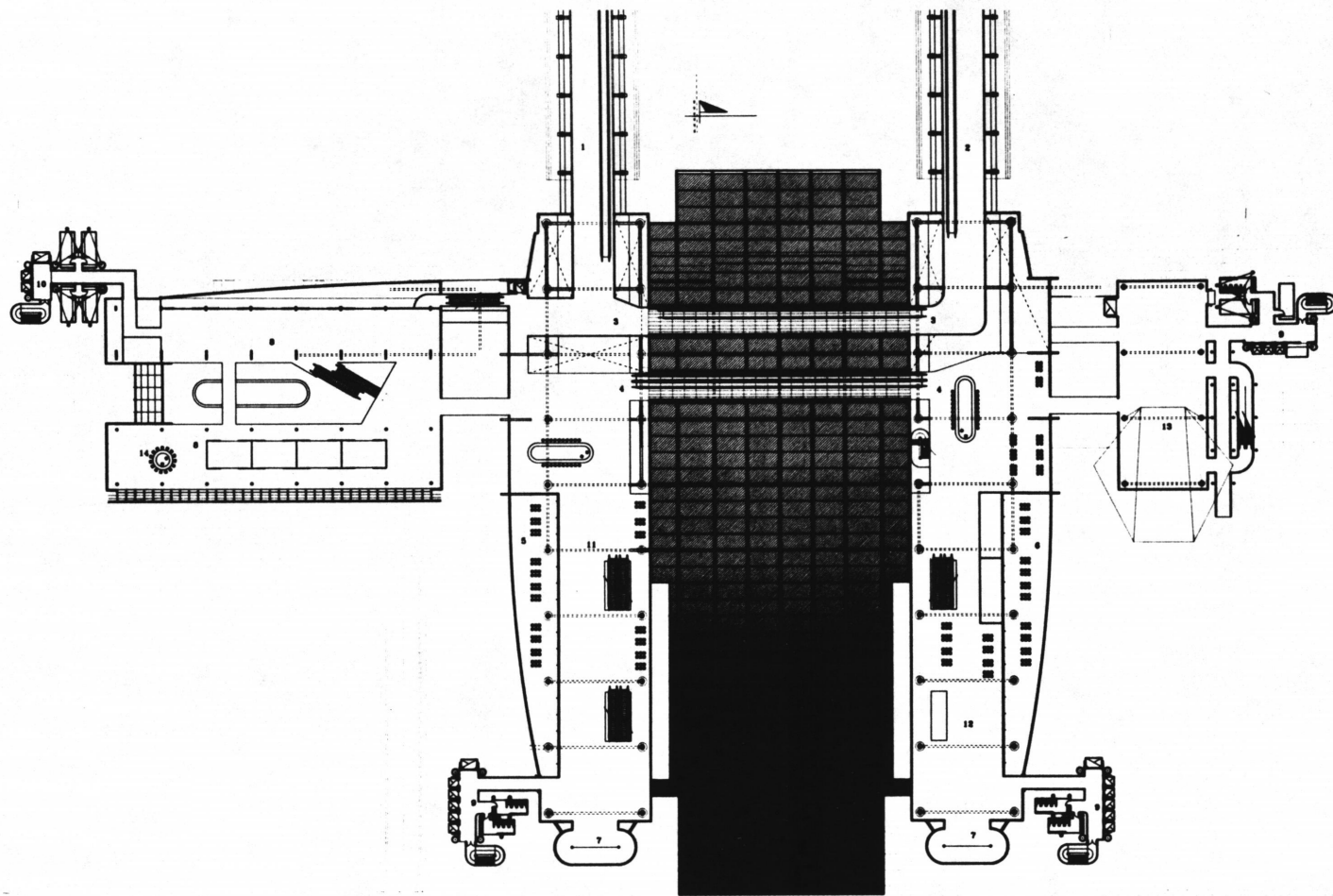


- 1.- MAIN HALL
- 2.- EAST SOUND SHOPS
- 3.- WEST SOUND SHOPS
- 4.- CAFETERIA
- 5.- INTERNATIONAL ARRIVALS CONNECTOR TO BRICKWORKS FROM GATE
- 6.- DUTY FREE SHOPS (CENTRAL COURT)
- 7.- MULTI LEVEL WEST BALL
- 8.- VERTICAL PASSENGER TRANSPORTATION / EXT. TOWER
- 9.- VERTICAL PASSENGER TRANSPORTATION / INT.
- 10.- VERTICAL EMPLOYEES TRANSPORTATION / TOWER
- 11.- SERVICE ROOM
- 12.- SOUTH DECK
- 13.- EXPANSION / MULTIPURPOSE

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|----------------------|----------------|----------------------|--------------------------|---------------------|-------------------------------------|-------------------|--|---------------|--|------------------|------|----------------------|---------------|--------------|---------|
| DRAWING NAME: | 4TH LEVEL PLAN | PROJECT NAME: | VANDERBILT INTERNATIONAL | Description: | 4th Level Floor Plan + shop area | Reference: | to show: SU, STW, PWBW, LINDA/ SUNDY/ CLARK/ HARRY/ | Notes: | 4th level floor plan + shoping / expansion / walking area & service / etc/ etc. | Symbology | none | Drawing Units | master metric | SCALE | 1 : 400 |
|----------------------|----------------|----------------------|--------------------------|---------------------|-------------------------------------|-------------------|--|---------------|--|------------------|------|----------------------|---------------|--------------|---------|

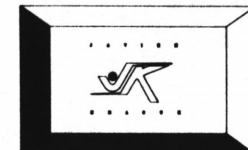


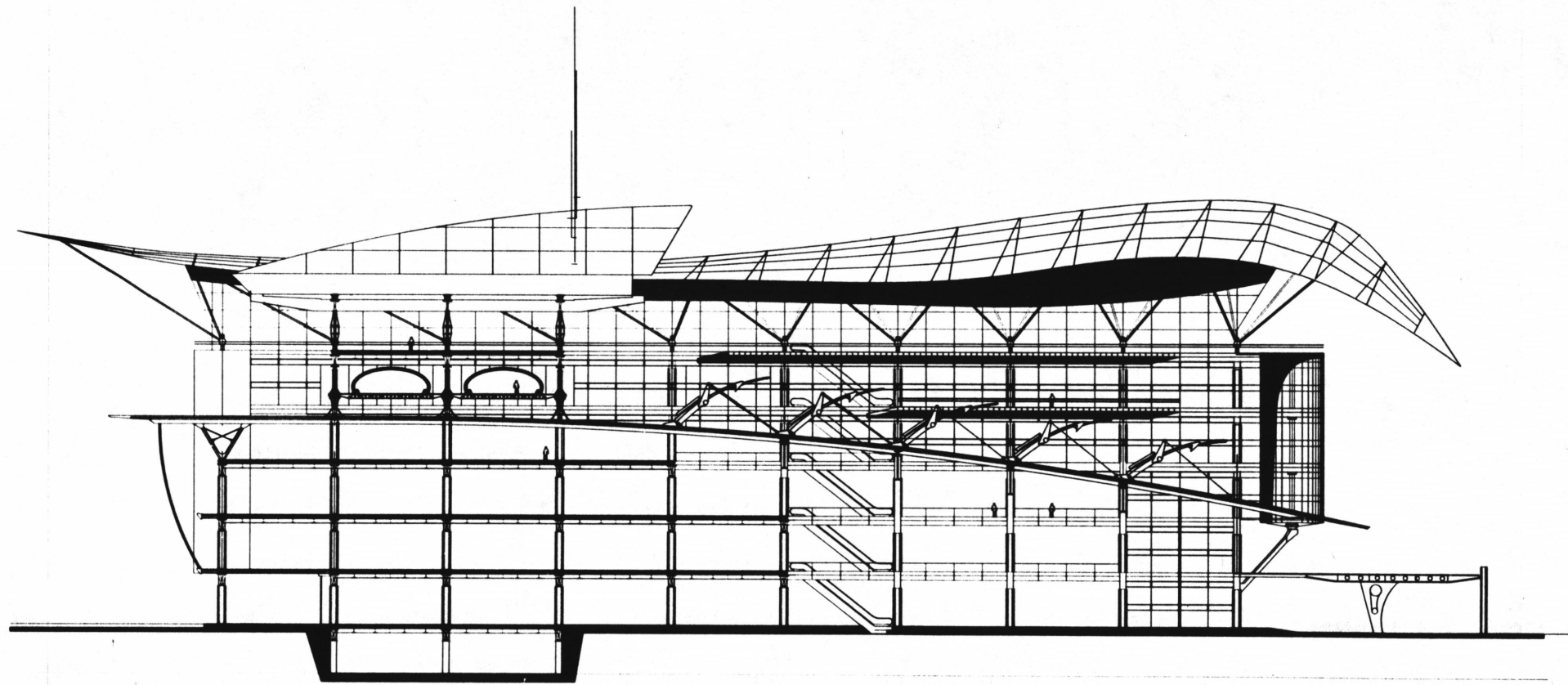


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- 1.- WEST SOUND CONNECTOR
- 2.- EAST SOUND CONNECTOR
- 3.- INTER GATES CONNECTOR (ISOLATIONS)
- 4.- INTER SOUND CONNECTOR (MAIN TERMINAL)
- 5.- WEST DECK
- 6.- EAST DECK
- 7.- FRONT DECK
- 8.- WEST HALL / ROOPS
- 9.- WEST VERTICAL TRANSPORTATION / EXT. TOWER
- 10.- EAST VERTICAL TRANSPORTATION / EXT. TOWER
- 11.- WEST SOUND ROOPS / MAIN HALL
- 12.- EAST SOUND ROOPS / MAIN HALL
- 13.- MULTI PURPOSE
- 14.- SECURITY
- 15.- INFORMATION

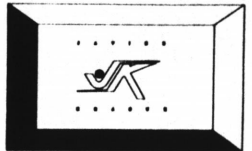
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| DRAWING NAME: 6TH LEVEL FLOOR PLAN | PROJECT NAME: TRANSITATION | Description: Main terminal 6th level plan | Reference: to file : 01/ 010/ 0100/ 01000/ 01000/ 01000/ 01000/ | Notes: 6th Level Floor Plan Main terminal 6th level plan Main terminal 6th level plan Main terminal 6th level plan | Symbology: none | Drawing Units: master metric | SCALE: 1 : 400 |
| DRAWING FILE : 01000 | | | | | | | |

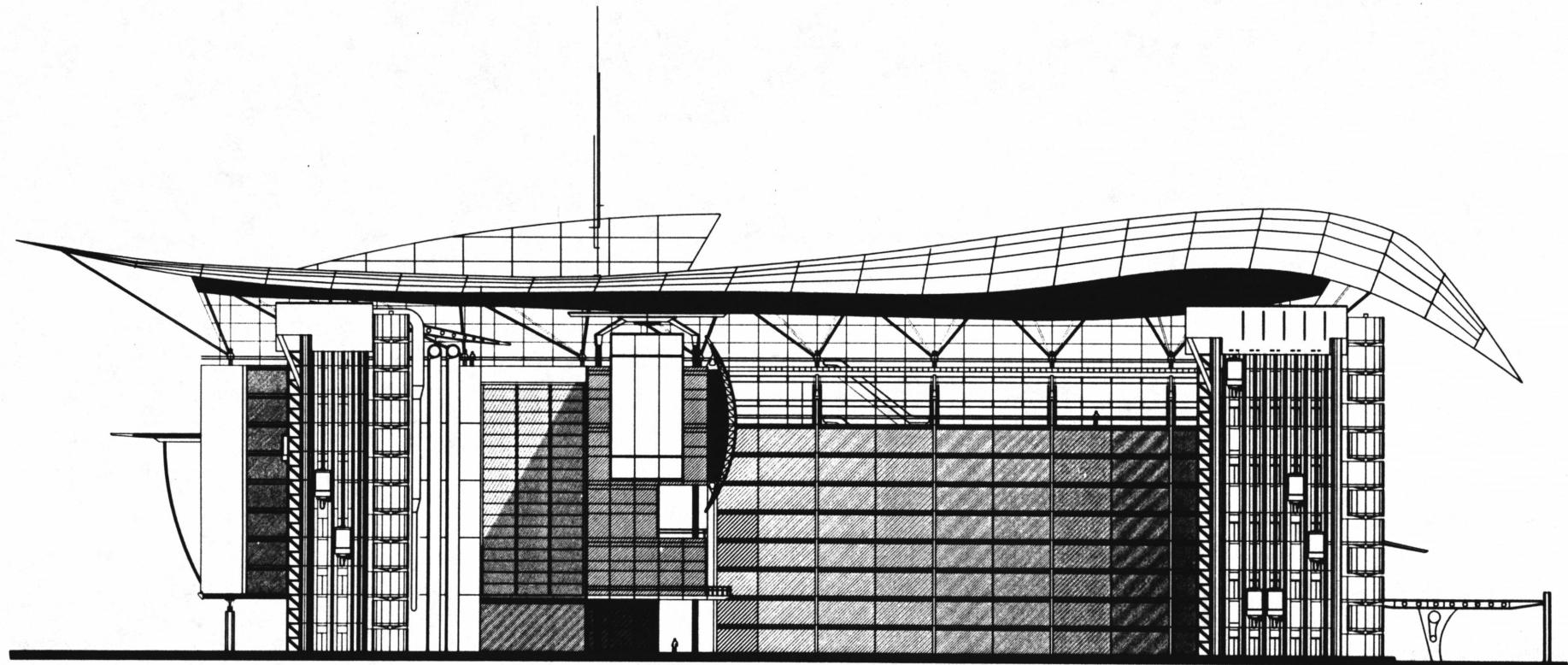




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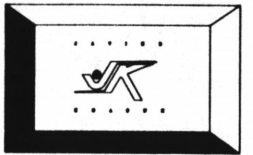
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| DRAWING NAME: MAIN TERMINAL SECTION | PROJECT NAME: PASADENA INTERNATIONAL AIRPORT AIRPORT TERMINAL | Description: SECTION ACROSS MAIN HALL | Reference: to file: "TERMINAL" / "TERMINAL" | Notes: Section showing levels and main layout include transformations / outcroped cut | Symbology: NONE | Drawing Units: master [metric] | SCALE: 1:200 |
|---|---|---|---|--|---------------------------|--|------------------------|

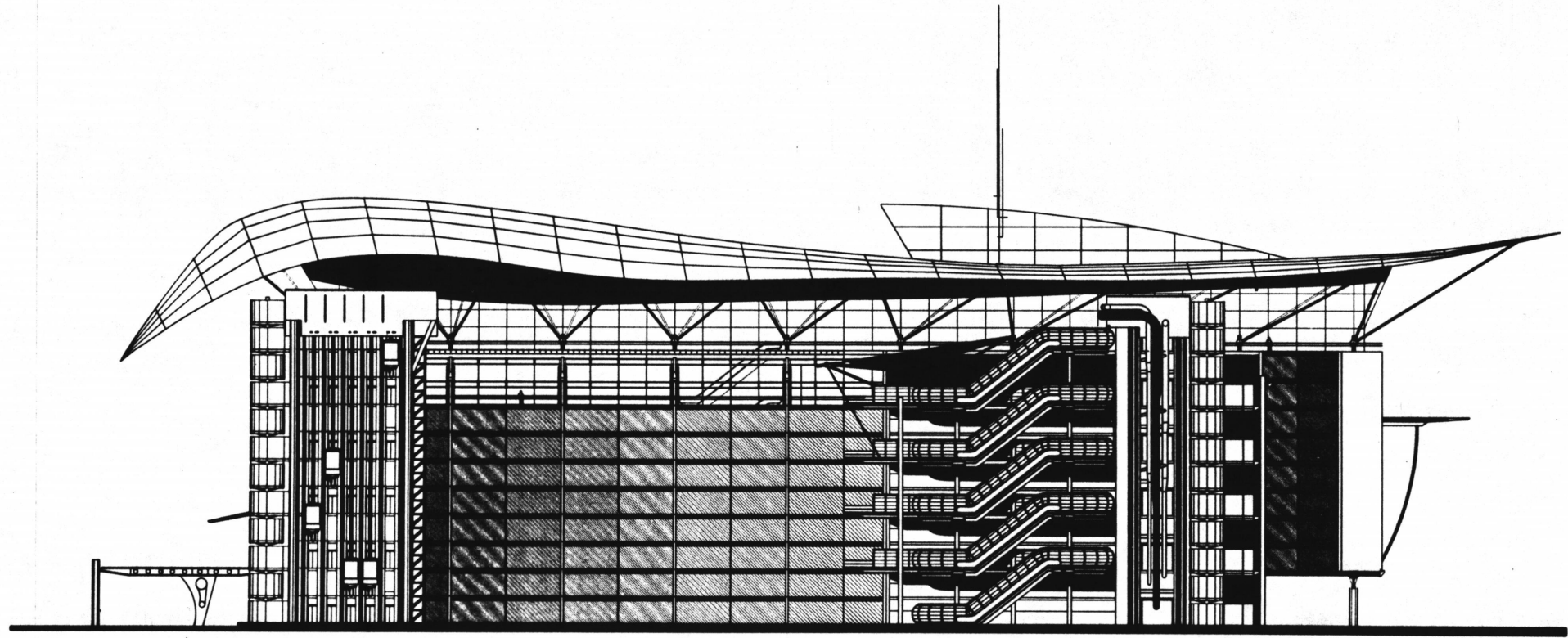




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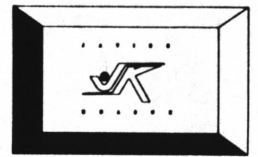
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| DRAWING NAME: WEST VIEW | PROJECT NAME: TRANSPORT OPERATIONAL | Description: West side view of PROTOTYPE MAIN TERMINAL | Reference: to the - VISUAL/CONCEPT | Notes: Site plan showing roof displacement + vertical passage and employee transportation | Symbology none | Drawing master | Units metric | SCALE 1 : 200 |
|-----------------------------------|---|--|--|--|--------------------------|-----------------------|------------------------|-------------------------|

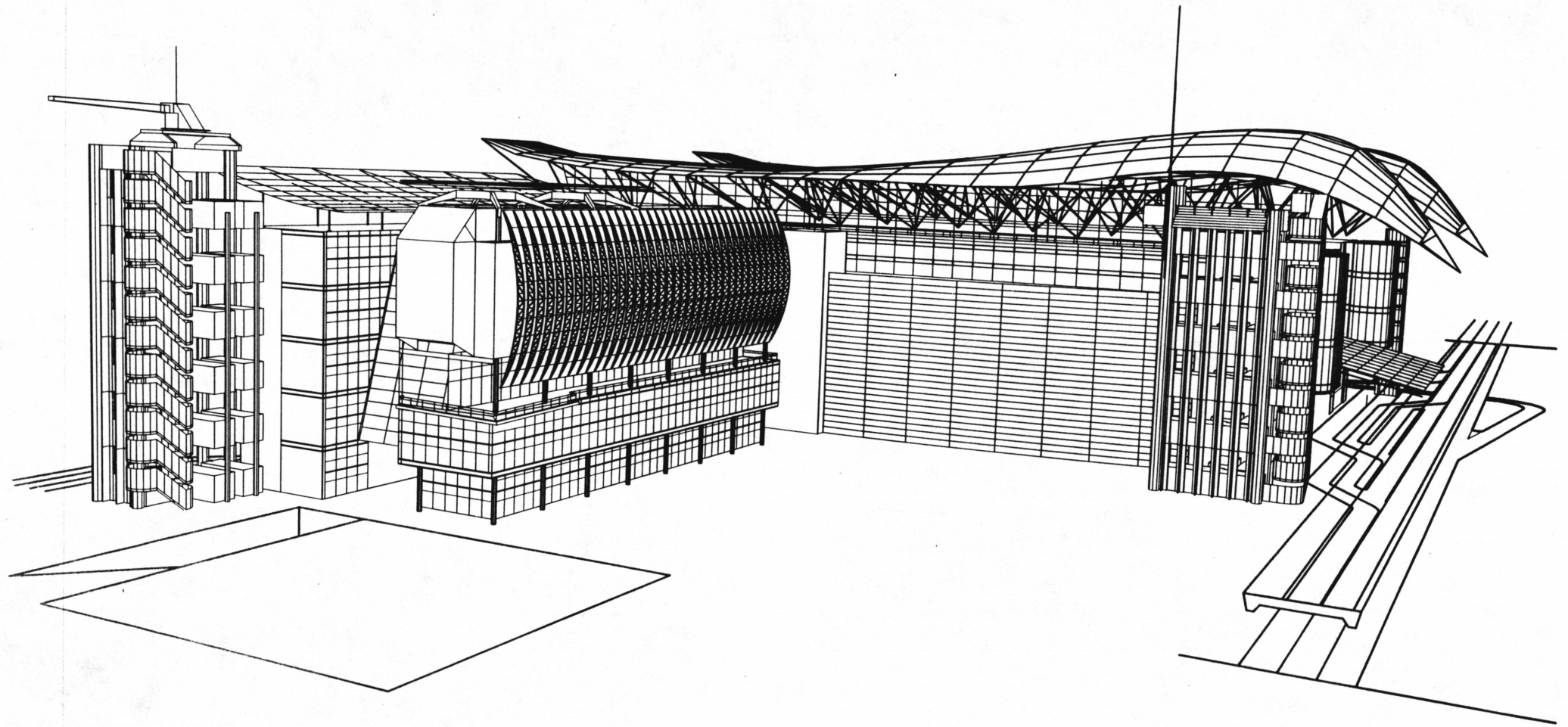


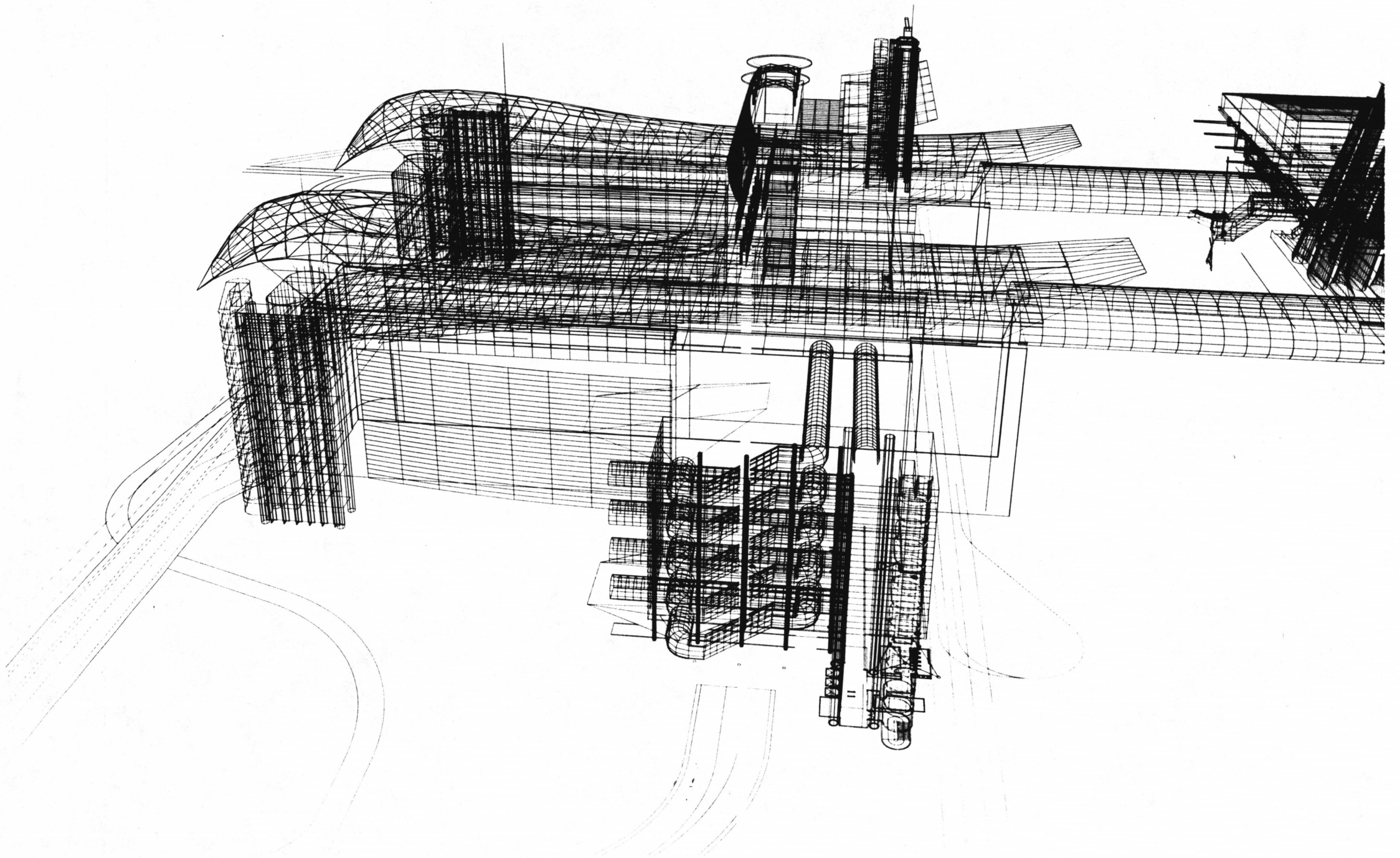


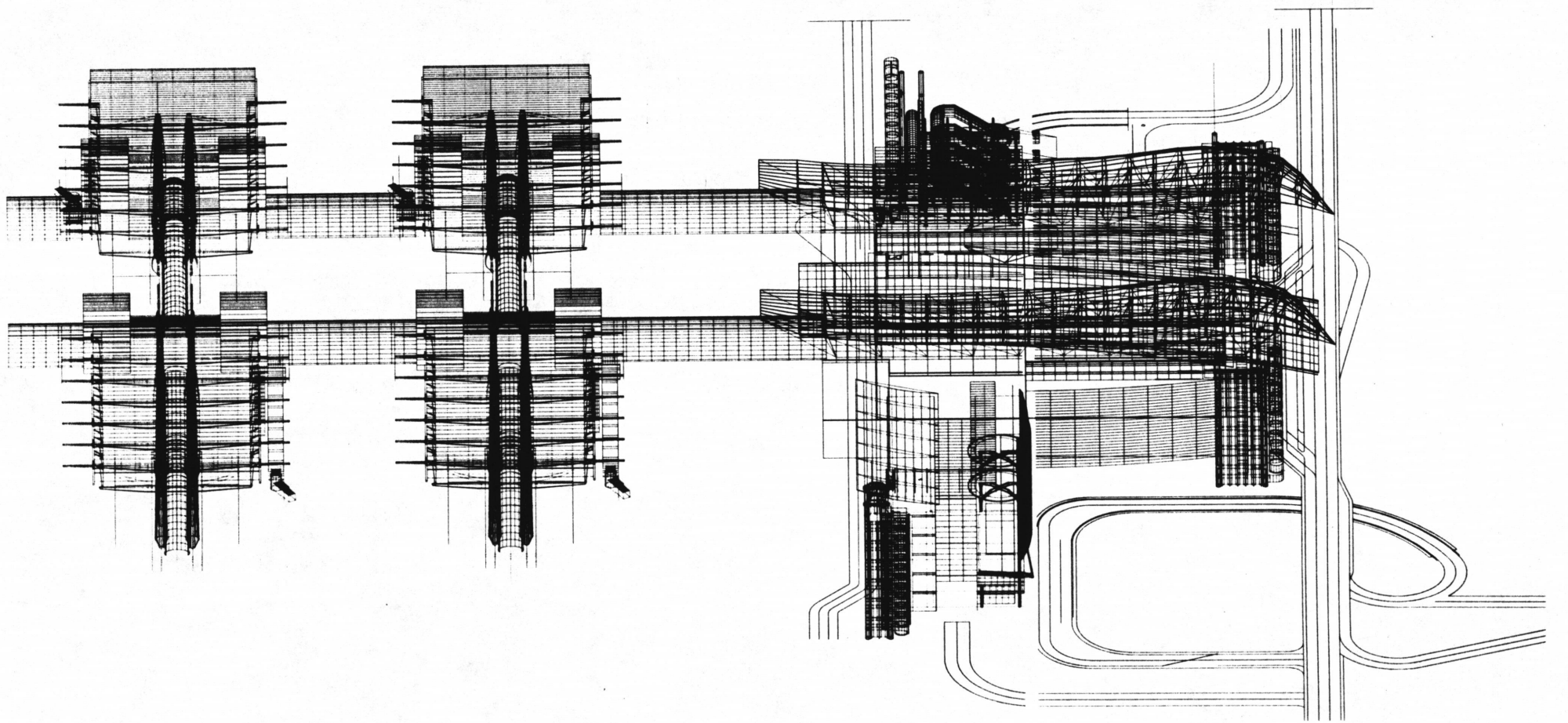
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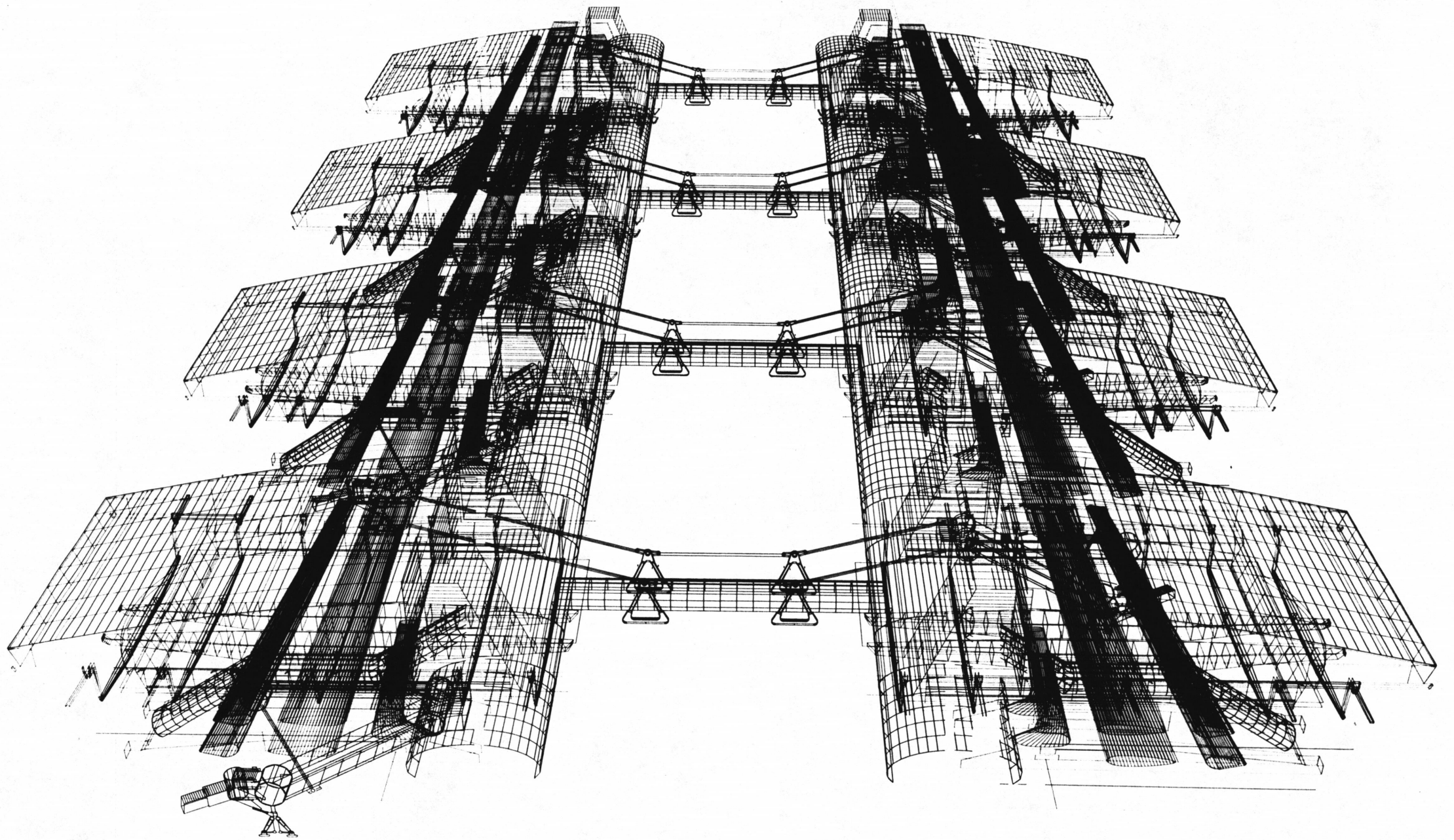
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| DRAWING NAME: DAY ONE VIEW | PROJECT NAME: KUALA LUMPUR INTERNATIONAL AIRPORT | Description: DAY ONE VIEW - 1st FLOOR | Reference: to site / survey / contract / survey | Note: 1. All dimensions are in millimeters unless otherwise stated. 2. All dimensions are to the center of the member unless otherwise stated. 3. All dimensions are to the face of the member unless otherwise stated. | Symbology NONE | Drawing master | Units metric | SCALE 1 : 200 |
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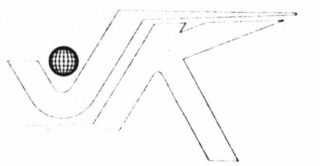
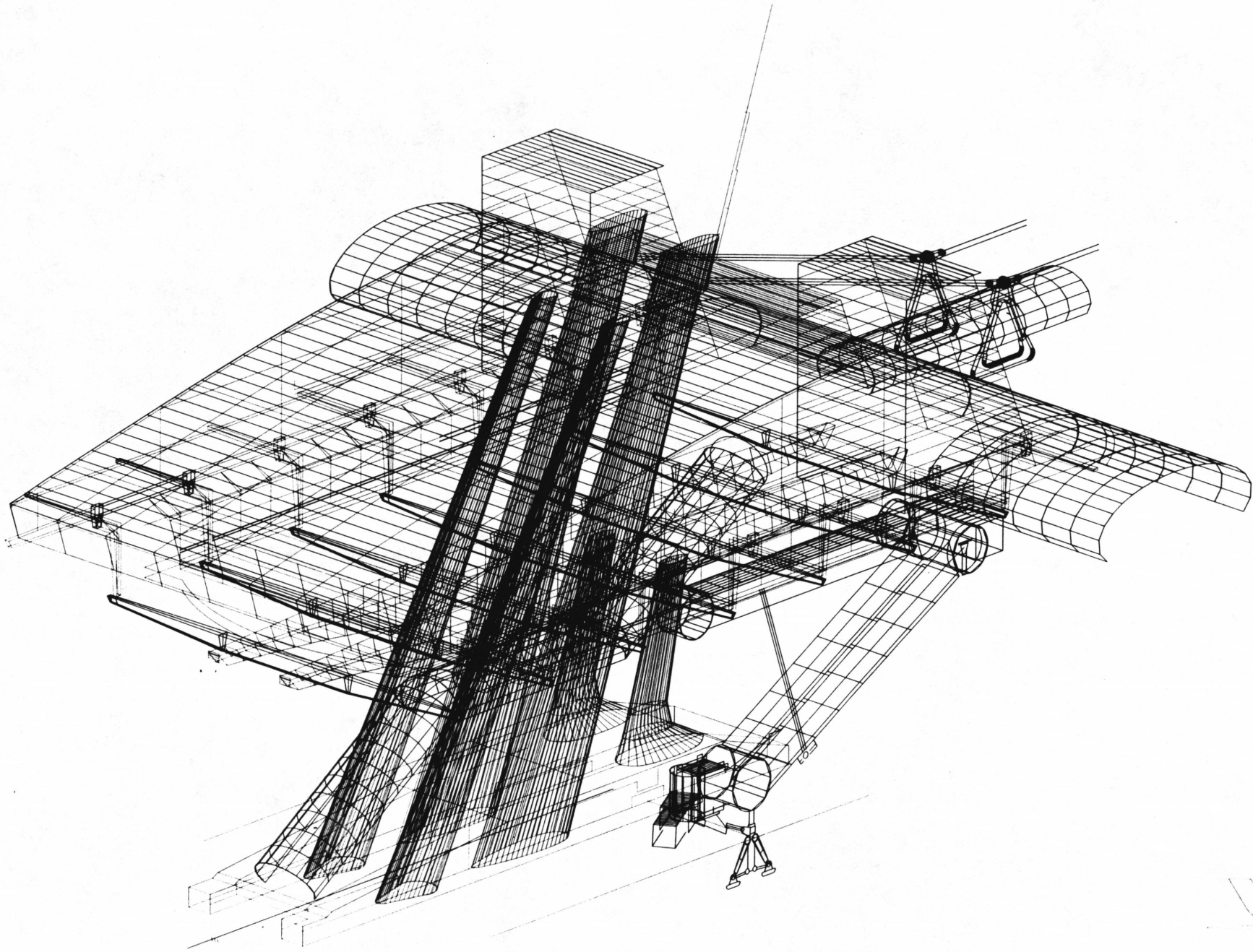


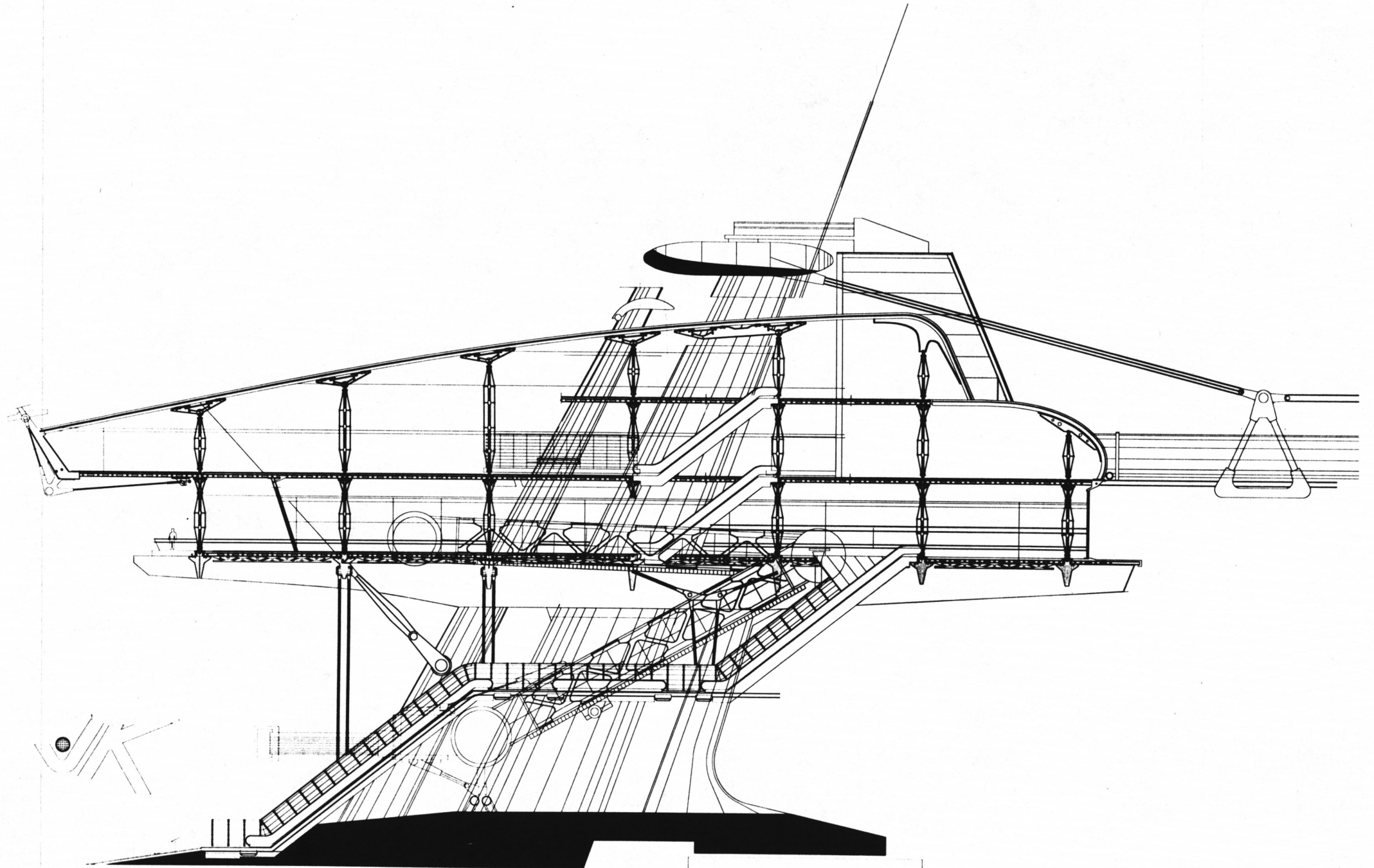




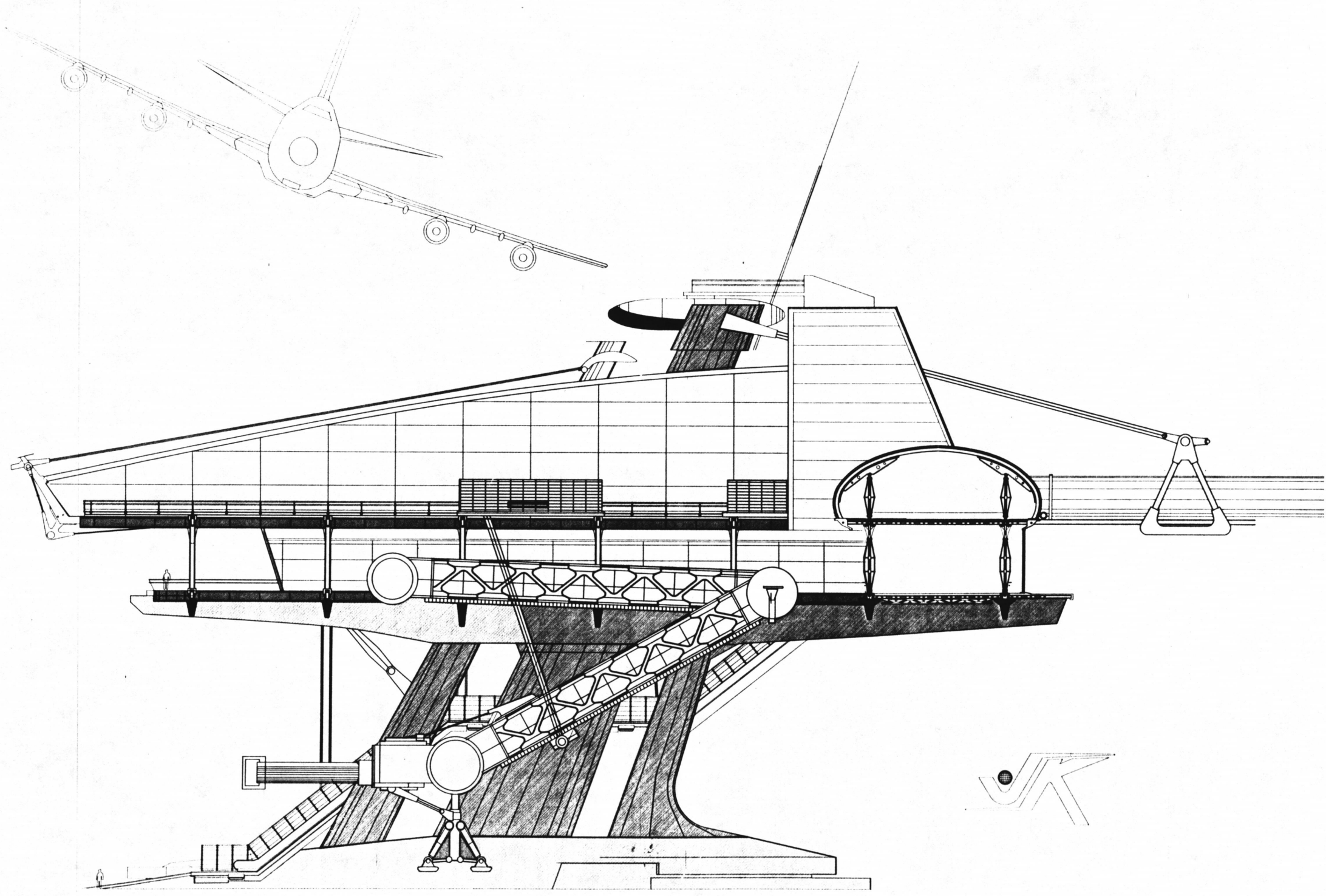


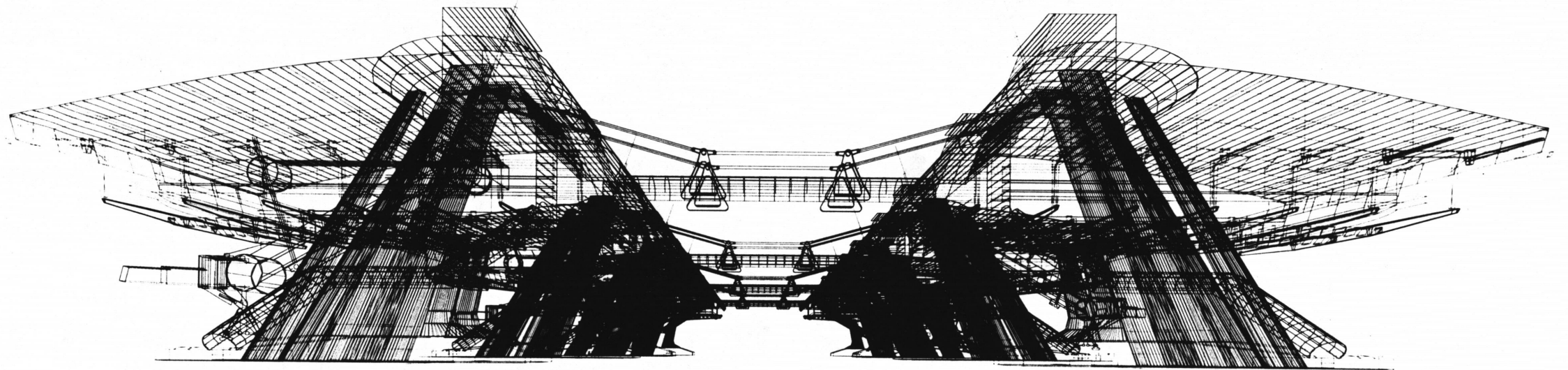


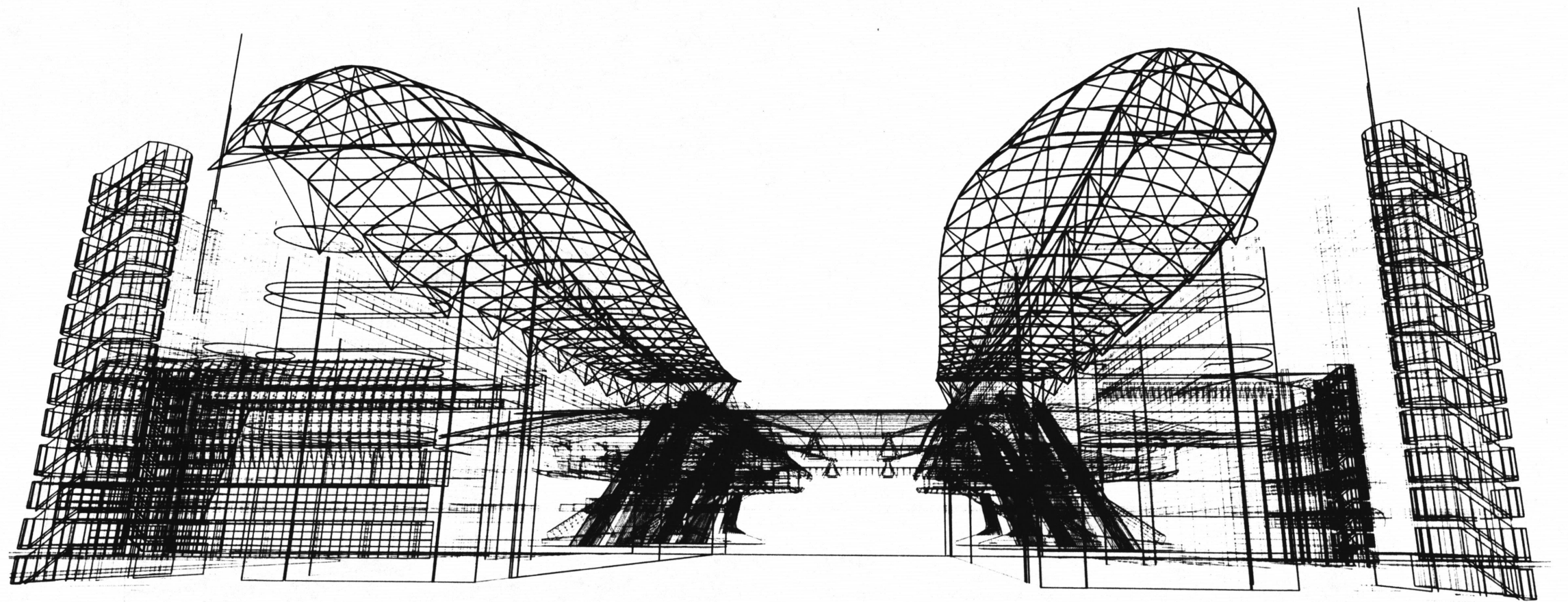




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