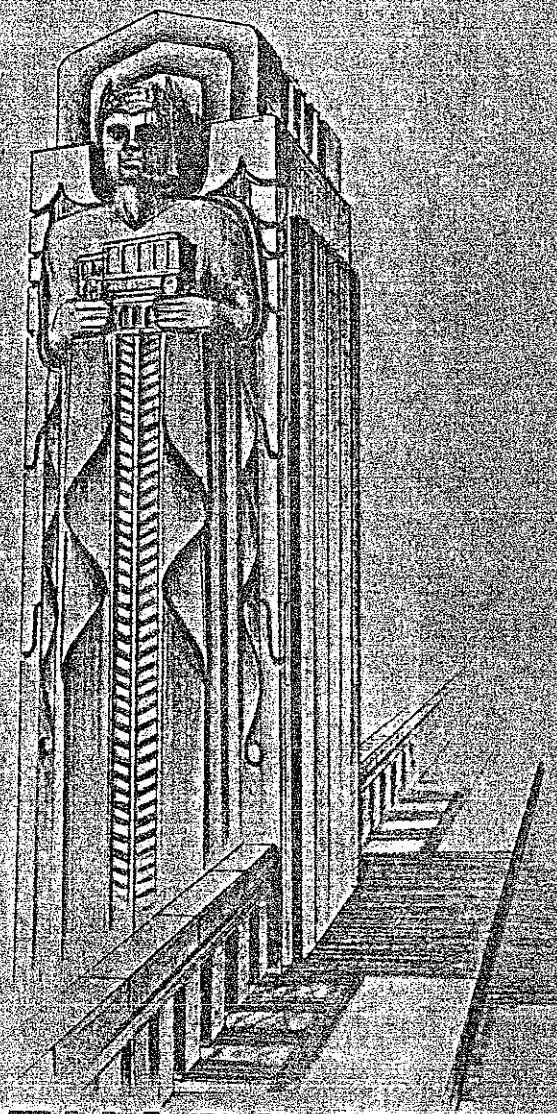
PRELIMINARY ONLY



APRIL
1969

REHABILITATION STUDIES

LORAIN CARNEGIE BRIDGE

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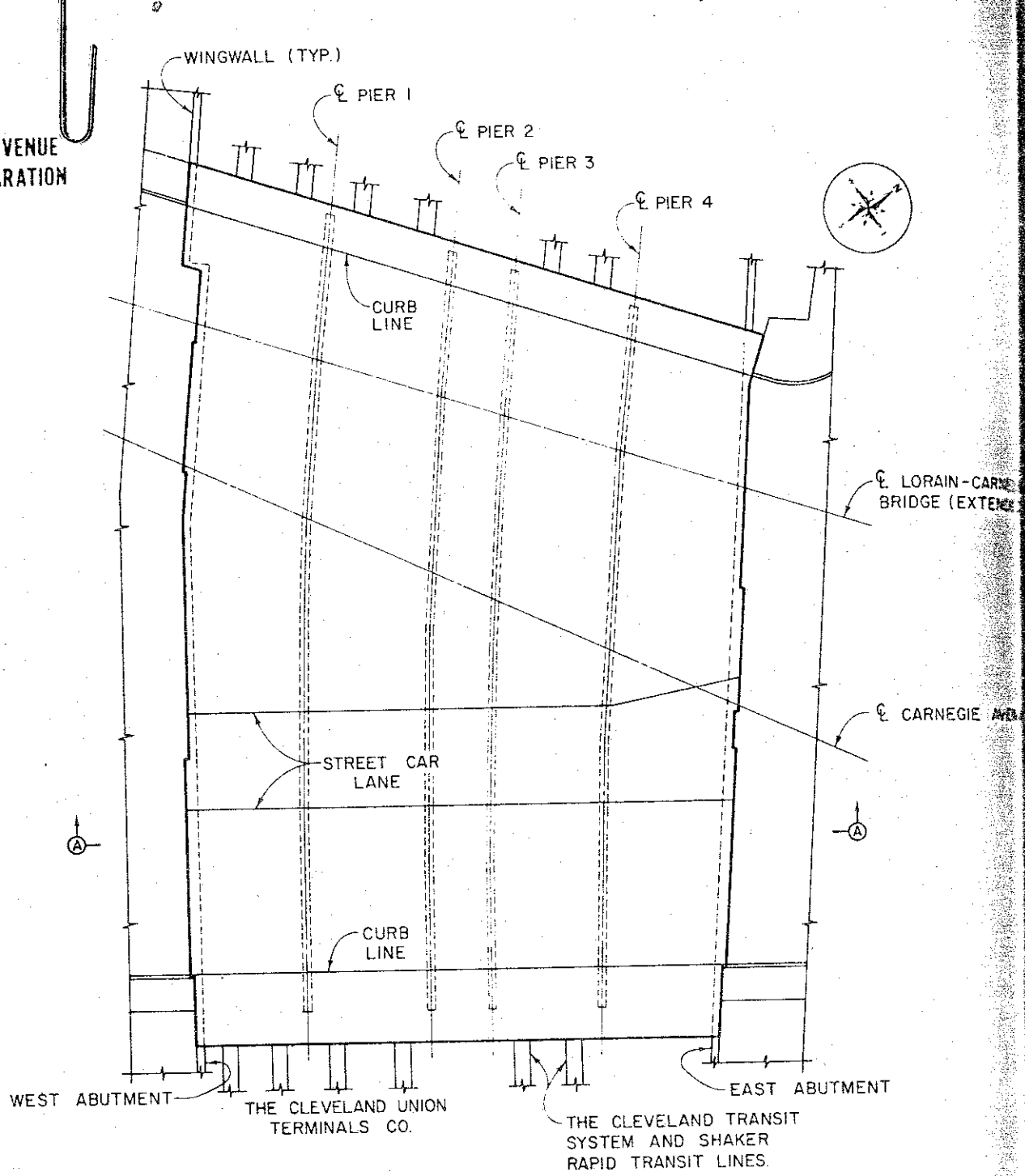
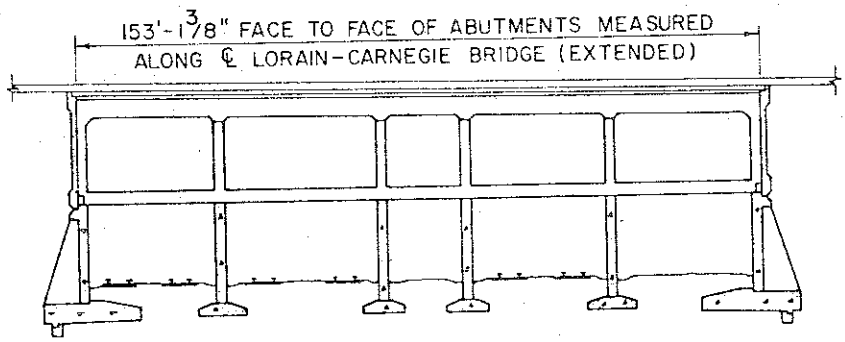
HNTB

FIGURE 5
CARNEGIE AVENUE
GRADE SEPARATION
STRUCTURE



PLAN
(SHOWING EXISTING CONDITIONS)



ELEVATION A-A

The approach roadways are supported on embankment between retaining walls. At the west approach, the retaining walls continue approximately 375 ft beyond the abutment bearings. At the east end, the north wall continues to adjoin the rapid transit grade separation structure, but the south wall terminates at the Commercial Road intersection.

A General Plan and Elevation of the Carnegie Avenue Grade Separation Structure over the Rapid Transit tracks is shown on Figure 5. This bridge was designed to carry two tracks of street railway traffic and several converging lanes of vehicular traffic on the upper deck with provisions for six tracks of street railway traffic on a future lower deck. The structure comprises five variable length reinforced concrete girder spans having a total length of 153 ft.

C. Lorain-Carnegie Bridge

1. Truss Spans

The steel truss spans over the Cuyahoga River Valley are of deck design, the main carrying elements being Pratt trusses. Each span has four parallel trusses except the simple span at the east end which has three variably spaced trusses. The main members of the trusses are box sections made up of plate and angle channel sections riveted together with lacing bars. Lateral bracing is provided in the exterior bays in the plane of the lower chord members. Each truss line is supported by a pair of bearings on reinforced concrete piers.

The upper roadway deck is a reinforced concrete slab topped with an asphaltic wearing surface. The deck is supported by longitudinal stringers which span between transverse floorbeams. The floorbeams are supported on the top chords of the trusses at panel points (See Figure 6). A planned lower roadway deck has not been constructed, but floorbeams for all three bays are in place. A reinforced concrete utility deck, located in the center bay below the planned lower deck, is carried on longitudinal stringers and transverse floorbeams which are connected to truss verticals.

TABLE II

DESIGN RATING OF EXISTING MEMBERS

LORAIN-CARNEGIE BRIDGE

Location	Member	HS Rating		
		4 Lanes	5 Lanes	6 Lanes
Truss Spans	Interior Stringers	22.2	22.2	20.7
	Fascia Stringers	41.4	42.0	11.7
	Intermediate Floorbeams			
	Center Bay	13.4	16.1	15.3
	Exterior Bays	28.8	24.5	22.9
West Approach Spans	Interior Stringers	25.3	25.3	23.8
	Fascia Stringers	30.1	30.5	8.5
	Intermediate Floorbeams			
	Center Bay	12.4	16.5	15.3
	Exterior Bays	14.1	14.0	13.8

bridge are as follows:

Minimum Yield Point

ASTM A7 - 30,000 psi

ASTM A94 - 45,000 psi

Basic Allowable Design Stress

ASTM A7 - 16,000 psi

ASTM A94 - 24,000 psi

The minimum design ratings obtained using the above allowable stresses are shown in Table II. In order to meet current design standards for modern loadings, the Lorain-Carnegie Bridge should be rehabilitated to provide a minimum rating of HS-20. From a study of Table II, it is apparent that, in the truss spans, the intermediate floorbeams in the center bay will require strengthening for all alternates, and that the fascia stringers will require strengthening for the six-lane alternate. In the approach spans, all floorbeams require strengthening for all alternates, and the fascia stringers must be strengthened for the six-lane alternate. Because of the complexities created by the difference in eccentricity for dead and live loads, the steel columns in the approach spans were not rated, but instead the stresses were checked for HS20 loading. All columns of the approach spans will require strengthening.

At the time of the original construction, the beams used for the intermediate floorbeams in the exterior bays of the truss spans were the minimum sections available with the desired depth. As a result, these floorbeams were understressed for the original design. The ratings shown in Table II assume these members to be in new condition. Deterioration though has occurred in some of the floorbeams adjacent to the curb stringers. Each beam flange could be corroded up to 1/16 inch without overstressing the members, and, for the purposes of this report, it has been assumed that repair or strengthening will not be required.

B. Carnegie Avenue Grade Separation

Design rating of deteriorated reinforced concrete members is not feasible. Therefore, preliminary design of the Carnegie Avenue Grade

Separation consisted of checking the capacity of the members for their repaired condition.

Allowable stresses used for existing concrete members were based on their original composition and on design stresses prevalent at the time of construction. These values should be checked by testing representative core borings prior to preparation of contract plans for reconstruction work. For analyzing the Carnegie Avenue Grade Separation the following values were used for existing materials:

Concrete:	Ultimate Compressive Strength	f'c = 3,000 psi
	Basic Allowable Compression	fc = 1,200 psi
	Shear	fv = 90 psi
	Modular Ratio(Es/Ec)	n = 10
Reinforcing Steel:	Basic Allowable Tension	fs = 18,000 psi

The allowable stresses for new materials were in accordance with the American Association of State Highway Officials 1965 Standard Specifications for Highway Bridges including the Ohio Department of Highways Supplement thereto.

Considering the deck slab to be ineffective, the longitudinal girders were found to be deficient at the supports. By properly bonding the new deck slab to the existing girders to function as a T-beam, the girders, when repaired, will be adequate to carry HS 20 loads. The columns and other substructure elements, when restored, will be adequate for HS 20 loadings without strengthening.

For Repaired Condition