FORM 1400-2

MICHIGAN

STATE HIGHWAY DEPARTMENT

LANSING 13

CHARLES M. ZIEGLER
STATE HIGHWAY COMMISSIONER

172

INTEROFFICE COMMUNICATION

February 21, 1952

TO: W. W. McLaughlin

SUBJECT: Revision of present specifications covering adjustment of catch basin covers to proper elevation, to permit welding as alternate to brazing.

Research Project 51 G-59, Report No. 172

"General Specifications Covering Brazing and Welding of Legs to Catch Basin Covers."

At the request of T. Humphries, Construction Division, the Research Laboratory has investigated the feasibility of arc welding the steel supports used to support cast iron catch basin covers at proper elevation in bituminous resurfacing projects, compared with the present practice of brazing. It was the purpose of this investigation to determine whether welding might reasonably be permitted as an alternate to brazing, and if so, under what conditions.

A number of full-size (1" by 2" cross section) steel blocks were welded to cast-iron blocks by experienced welders, using welding rods furnished by Mr. Humphries (1) from a job on which they had been used for this purpose and (2) from a welding supply company in Kalamazoo, and (3) rods recommended by local supply companies. Similar samples were brazed for control purposes. All welding and brazing operations were conducted under laboratory supervision, and observations were recorded as to ease of welding, appearance, etc.

Specimens were broken by impact in an Izod impact testing machine; others were sectioned and polished for metallographic evaluation. Accompanying photographs show metallographic sections of a brazed specimen, a specimen welded with a rod containing nickel, (such as the rods used on Woodward Avenue) and of a specimen welded with a phosphor bronze rod.

Impact tests showed that under ideal conditions the brazed specimens possessed the highest resistance to failure by impact. Specimens welded with a phosphor bronze welding rod according to manufacturer's instructions showed resistance to failure by impact of comparatively high amount. Specimens welded by all other available types of welding rods varied from practically zero to negligible resistance to failure by impact, even when welded according to manufacturer's instructions.

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The accompanying photographs show how the braze metal and the phosphor bronze metal tend to flow into and "wet" the junction of steel and cast iron, and how the ordinary welding metal has burned the cast iron, melted it, and produced high stresses. Microscopic examination showed that in specimens welded with rods other than phosphor bronze, the intense heat caused structural changes (deposition of Martensite) to take place in the cast iron, rendering it brittle. In such cases, failure occurred in the brittle portion of the iron. Failure of brazed and bronze-welded specimens occurred within the joining metal.

In consideration of these results, it is felt that arc welding may be permitted as an alternate to brazing in this application, provided that phosphor bronze welding electrodes are used, and that the rod manufacturer's instructions relative to current and polarity are followed. Accordingly, the attached revised specification is submitted for your consideration.

The phosphor bronze rod used was furnished by the Central Welding Supply Co., Inc., 214 Reasoner St., Lansing 5. It is manufactured by the All-State Welding Alloys Co. of White Plains, New York, and is their number 24 DC reverse polarity, 160-180 amps.

Other rods used but considered inadequate included the following:

Airco, obtained from Hermann Niesel at Motor Transport Division
Eutectic 24/50 AC-DC from Eutectic Welding Alloys Corp.
Eutectic used on Woodward Ave.
Bergstrom Mangalloy W from Welders Supplies & Gases, Kalamazoo

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cc: C. H. Cash
T. Humphries

PROPOSED SPECIFICATION COVERING ADJUSTMENT OF CATCH BASIN COVERS

ADJUSTING CATCH BASIN COVERS - WELDED: Where called for in the logs, or authorized by the engineer, existing covers shall be adjusted to proper elevation by brazing or welding steel blocks to the cover. If the union is made by arc welding, only a phosphor bronze welding rod may be used. Recommendations of the rod manufacturer with respect to current and polarity shall be followed. The blocks shall be 1 " x 2 " by whatever length is necessary as directed by the engineer. Eight blocks shall be used for each cover. One shall be attached to each of the four corners and one to each of the intermediate points. Attachment shall be performed with attention to the following details:

1. The cast iron grates shall be thoroughly cleaned of scale and rust by grinding.

2. The steel supports shall be beveled at least 1/4" at the end in contact with the cast iron grates.

3. The steel supports shall be clamped in position while the union is made, using precautions to maintain the steel blocks in a position normal to the grate.

4. The joining metal shall extend entirely around the steel support.

Method of Measurement: Adjusting catch basin--welded--will be measured as units of each cover.

Basis of Payment: Adjusting catch basin covers--welded--will be paid for at the contract unit price, each, which price shall be payment in full for removing, brazing or welding, furnishing all material and labor in adjusting the cover to the required elevation, and replacing the cover.

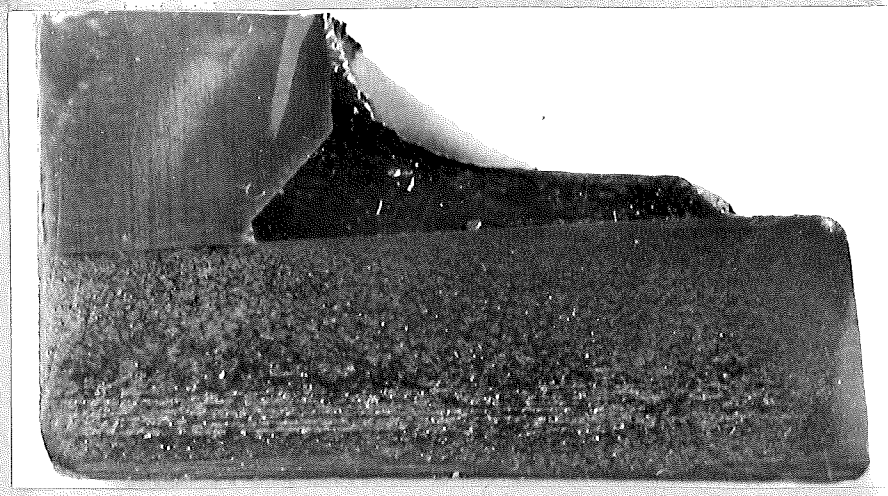

Figure 1. Cross-section showing upper steel block brazed to lower cast-iron block. Note complete filling of space by braze metal, and absence of burned areas.

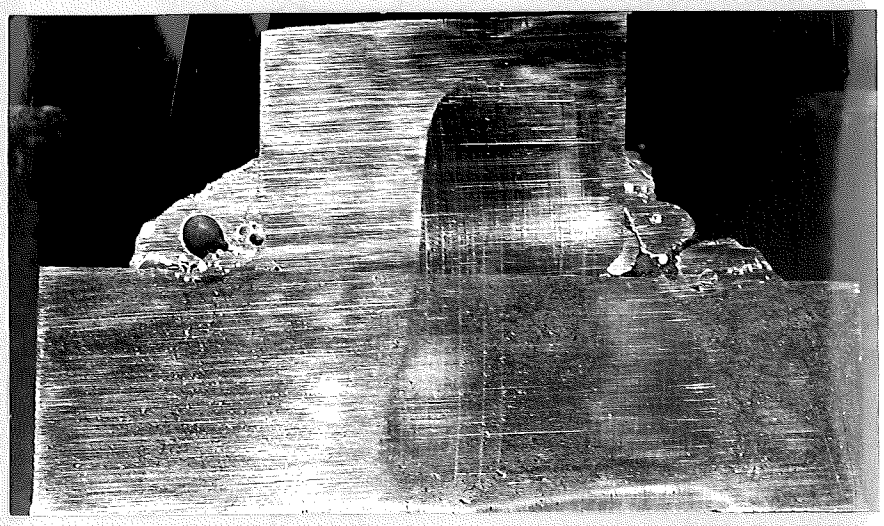

Figure 2. Cross-section showing upper steel block welded to lower cast-iron block using phosphor bronze welding rod. Note complete filling of space by weld metal, and absence of burned areas.

Figure 3. Cross-section showing upper steel block welded to lower cast-iron block using conventional welding rod. Note p filling of space by weld metal, and burned areas in cas iron.