

INVESTIGATION OF STRUCTURAL TEES,  
GALVANIZED IN SECTIONS, IN A TRUSS-TYPE  
PEDESTRIAN BRIDGE

(Work Plan No. 22)

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MICHIGAN DEPARTMENT OF STATE HIGHWAYS

INVESTIGATION OF STRUCTURAL TEES,  
GALVANIZED IN SECTIONS, IN A TRUSS-TYPE  
PEDESTRIAN BRIDGE

(Work Plan No. 22)

A. J. Permoda

Research Laboratory Section  
Testing and Research Division  
Research Project 73 G-197  
Research Report No. R-896

Michigan State Highway and Transportation Commission  
E. V. Erickson, Chairman; Charles H. Hewitt,  
Vice-Chairman, Carl V. Pellonpaa, Peter B. Fletcher  
John P. Woodford, Director  
Lansing, January 1974

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This is the first progress report covering an investigation of the use of structural tees, preassembled in sections before galvanizing, in a truss-type pedestrian bridge. The bridge is P01 of 52042 over US 41 in Harvey, southeast of Marquette, completed in 1972. The project is a "Category 2" experiment carried out in cooperation with the Federal Highway Administration as per MDSHT Work Plan No. 22 (Appendix A).

### Project Objectives

In accordance with the Work Plan, the objectives consist in determining the benefits that accrue in a truss-type pedestrian bridge, as observed by factors such as cost, construction ease, performance, and durability, by use of:

- 1) Structural tees as truss members rather than other structural shapes,
- 2) Galvanizing the structural truss members rather than painting them,
- 3) Galvanizing preassembled sections of the truss to insure good coating coverage of the fabrication junctures, rather than the individual truss panels.

The efficiency of the above will be evaluated by comparison with other standard truss-type pedestrian bridges, built contemporarily, as determined primarily by regular inspection personnel making annual surveys.

Explanatory Note: The Work Plan was developed and processed by the Department, and after erection of the pedestrian structure the project was transferred to the Research Laboratory for follow-up and reporting in early 1973. Subsequent reporting will depend on feed-back from the regular inspection teams.

### Construction of Bridge

From the construction file, with pertinent extracts in Appendix B, we note that erection work started on September 14, 1971, with opening to pedestrian traffic on December 1, 1971 (completed by the specified date of July 1, 1972). The galvanizing and its thickness were in accordance with specifications. The file has a note relating that an accident occurred during shipment of the galvanized bridge sections to the construction site, but that damage incurred in the dumping was minor and was corrected by straightening at the site.

The cost of the structure was \$43,370.70. This is 15 percent below the original estimate of \$50,000, and indicates that the test experimental features were not adding to the cost of the structure.

We did inspect the subject structure on September 27, 1973 and found the experimental features to be performing satisfactorily, after more than one year of service. Figure 1 shows the structure.

## Control Pedestrian Bridges

Finding control (comparison) structures, exposed in equivalent environment as the subject bridge, has posed a problem since to our knowledge that is the only pedestrian bridge in the Upper Peninsula.

Accordingly, we have to use a somewhat roundabout method of selecting subject controls. We are fortunate that another structure of the same design, except for length, was also built in 1972, north of Detroit. It is P02 of 50031 over M 97 in Fraser (Fig. 2). It is to be a secondary standard with other pedestrian bridges in the Lower Peninsula serving as controls. Tentatively, the selected controls, numbered to correspond with those listed under "Project Objectives," are as follows:

1(a). P01 of 50031 over M 97 at Rose Ave in Mt. Clemens built in 1966 (Fig. 3). Bridge consists of structural L's and T's. Truss-panel floor, walls, and roof were galvanized before assembly into panels, then into sections of four panels each. Section junctures do not employ the typical flanges.

(b). P02 of 33043 over M 78 at Harrison Rd in East Lansing built in 1970 (Fig. 4). It is built of square tubing, galvanized after preassembling in sections.

2(a). P02 of 63101 over I 696 east of Orchard Lake Rd north of Farmington built in 1962, but maintenance repainted by the Department in 1971 after accidental damage (Fig. 5). The truss is built of round tubing.

(b). P02 of 33032 over I 96 BL at Mason St in Lansing built in 1969 (Fig. 6). The truss is built of round tubing, painted.

(c). P01 of 24011 over US 31 in East Petoskey built in 1967 (Fig. 7). The truss is built of square tubing, painted.

3. Structures listed under 1 (a and b), above, can serve as "controls" for this Project Objective, also.

The above listed control bridges need not be considered as firm selections. If the survey teams find more representative structures they could be substituted for some of the above.

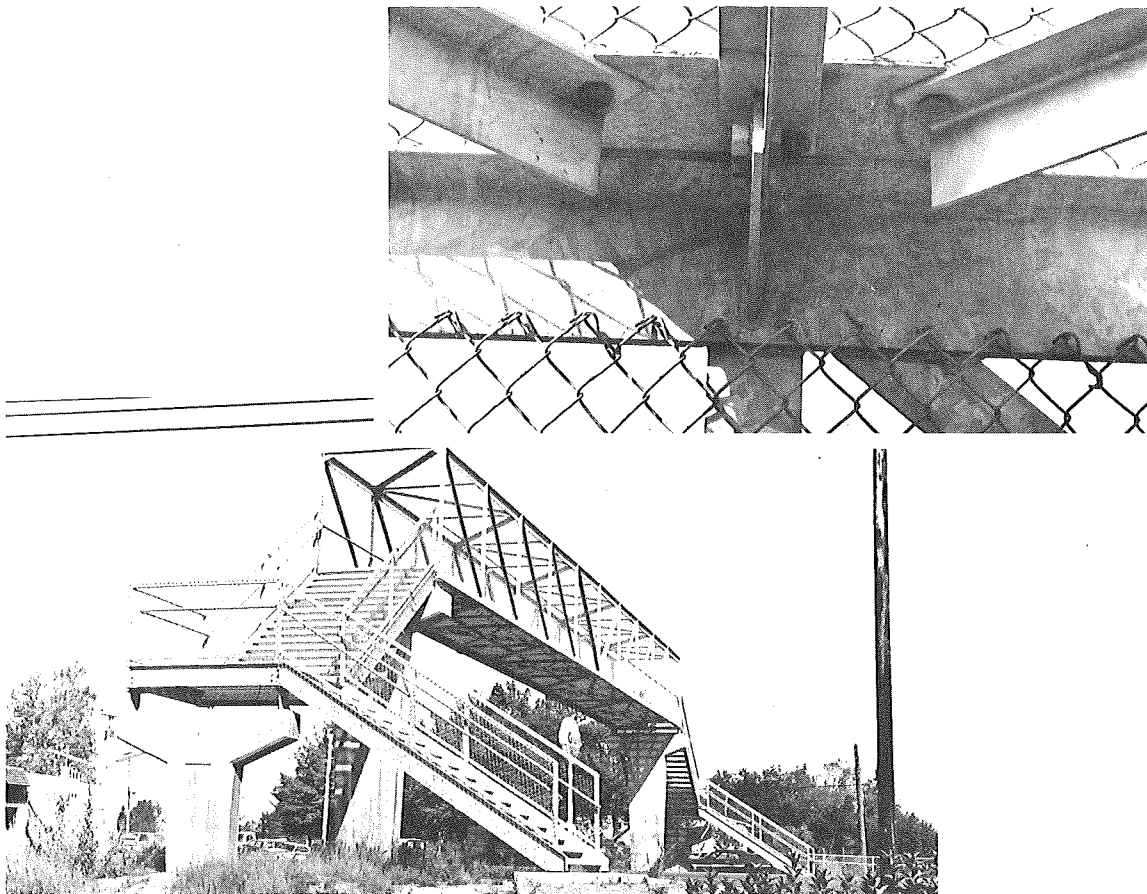


Figure 1. General appearance of P01 of 52042 (south stairs in foreground). Truss is 92-1/2 ft long. The close-up, at upper right, of sidewall and roof juncture, shows some bolted and some welded T-members.



Figure 2. P02 of 50031 over M 97 in Fraser is the test secondary standard (west stairs in foreground). Truss is about 132 ft long.



Figure 3. P01 of 50031 over M 97 at Rose Ave in Mt. Clemens. Bridge is galvanized.

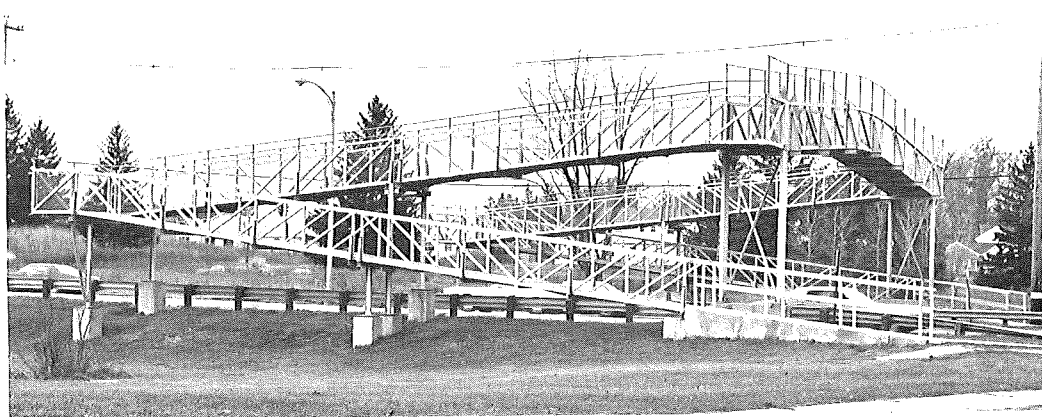


Figure 4. P02 of 33043 over M 78 at Harrison Rd in East Lansing (can be negotiated by bicycles). Bridge is galvanized.

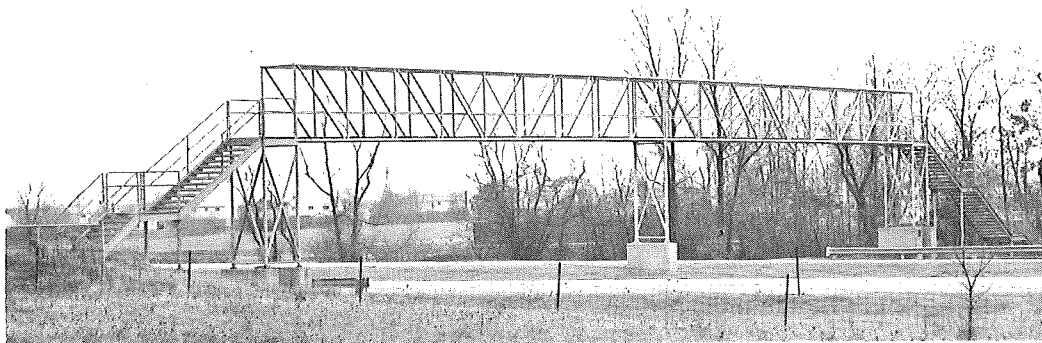


Figure 5. P02 of 63101 over I 696 north of Farmington. Maintenance repainting was necessary in 1971 due to collision damage.

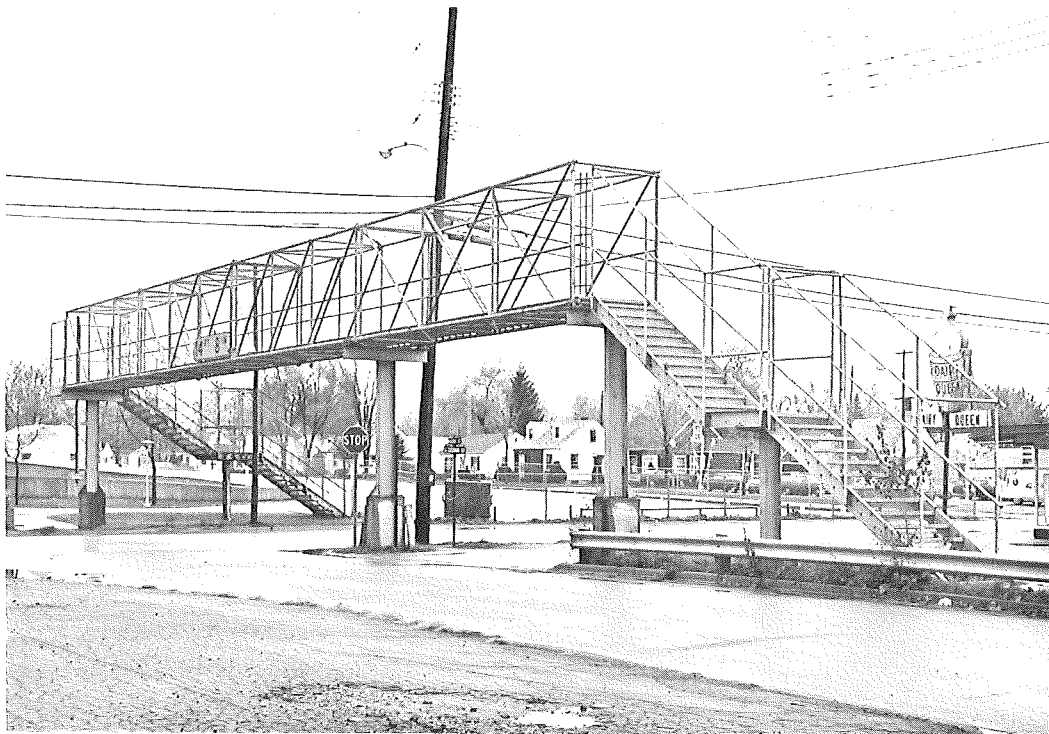


Figure 6. P02 of 33032 over I 96 BL at Mason St in Lansing. Truss is painted.



Figure 7. P01 of 24011 over US 31 in East Petoskey. Truss is painted.



APPENDIX A

HIGHWAY COMMISSION

E. V. ERICKSON  
CHAIRMAN

CHARLES H. HEWITT  
VICE CHAIRMAN

PETER B. FLETCHER  
CARL V. PELLONPAA

STATE OF MICHIGAN



WILLIAM G. MILLIKEN, GOVERNOR

**DEPARTMENT OF STATE HIGHWAYS AND TRANSPORTATION**

STATE HIGHWAYS BUILDING - POST OFFICE DRAWER K - LANSING, MICHIGAN 48904

JOHN P. WOODFORD, DIRECTOR

June 10, 1971

Mr. Daniel Watt  
Division Engineer  
Federal Highway Administration  
Lansing, Michigan

Dear Mr. Watt:

Proposed Category II Experimental Project  
Galvanized Steel Pedestrian Bridge  
Over US-41 in Harvey  
P01 of 52042 - Job No. 03674C  
Fed No. RF8-4(201)

In accordance with your request of June 2, 1971, we are submitting copies of a work plan for the above Category II experimental project.

We hope this data is sufficient to enable you to grant approval to our request of May 24, 1971, to construct this experimental structure so we may proceed with preparing the project for the July 21, 1971 letting.

Sincerely,

/s/ J. P. Woodford

JOHN P. WOODFORD  
Deputy Director - Chief Engineer



## WORK PLAN

Proposed Category II Experimental Project  
Galvanized Steel Truss Pedestrian Bridge  
P01 of 52042 Job No. 03674C Federal No. RF8-4(201)

- I OBJECTIVE: To observe the cost, construction, performance, and durability of a galvanized steel pedestrian bridge and compare the results with other truss-type pedestrian bridges. It is felt that using structural tees for truss members will result in improved welded connections and field splices over those on welded pipe trusses. Also by galvanizing the structure, after all fabrication has been completed, the maintenance cost should be reduced and the life of the structure prolonged.
- II CONTROL SECTION: No specific control section will be constructed with this project. Comparisons will be made with previously constructed and future pedestrian bridges.
- III MATERIALS AND METHOD OF CONSTRUCTION: Truss members will be made of structural tees. The truss, as well as the stairs and platforms, will be fabricated in sections, pre-assembled, and holes reamed for field bolts. The structure will then be disassembled and galvanized. Field connections will be made only by bolting with galvanized bolts.
- IV COST: Estimated construction cost for this project is \$50,000. This is approximately \$1,000 more than an identical painted truss-type pedestrian bridge would cost. However, the additional cost should be offset by reduced maintenance cost and longer structure life.
- V INSPECTIONS AND REPORTS: Inspections of this structure will be made during fabrication, after galvanizing, and during and after erection. In addition, inspections will be made on an annual basis as part of our regular bridge inspections to check welded connections, bolted connections, and galvanizing coating. Reports will be submitted following the construction of the structure, after each annual inspection, and when the experimental project is considered terminated (Final Report).

APPENDIX B

Letting of: July 21, 1971

10:30 A.M., Eastern Standard Time

State Highways Building Auditorium, Lansing, Michigan

<u>ITEM NO.</u>	<u>PROJECT</u>	<u>JOB NO.</u>	<u>FEDERAL NO.</u>
3	RF 52042	03674 A	RF 8-4 (201)

PEDESTRIAN BRIDGE OVER US-41 IN THE VILLAGE OF HARVEY, MARQUETTE COUNTY.

THIS PROJECT IS A FEDERAL AID PROJECT UNDER THE PROVISIONS OF THE FEDERAL AID HIGHWAY ACT OF 1968. AS DEFINED UNDER SECTION 113 OF TITLE 23 U. S. CODE AS AMENDED, THE DAVIS-BACON ACT IS APPLICABLE AND REQUIRES THE SECRETARY OF LABOR TO DETERMINE THE MINIMUM WAGE RATES TO BE PAID BY THE CONTRACTOR AND SUBCONTRACTORS, WHICH RATES WILL BE GIVEN IN DETAIL IN THE PROPOSAL.

Net classification required for this project is 5 Fa

Bid deposit required is \$ 2,000.00 Completion date is July 1, 1972

Plans may be examined at the Michigan Department of State Highways Crystal Falls

office.

The Department of State Highways, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252) and the Regulations of the Department of Transportation (49 C.F.R., Part 21), issued pursuant to such Act, hereby notifies all bidders that it will affirmatively insure that the contract entered into pursuant to this advertisement will be awarded to the lowest responsible bidder without discrimination on the ground of race, color, or national origin.

DATED: 6-21-71  
Lansing, Michigan

Lower Peninsula

C.L.B. nkm

## STRUCTURAL STEEL

### GENERAL

All work and materials shall be in accordance with the requirements of the Michigan Department of State Highways Standard Specifications for Highway Construction, 1970 Edition, or except as herein modified:

### GALVANIZING

All components shall be hop dip galvanized in accordance with current ASTM Specification A123 after welding is completed, except as herein modified:

The weight of the zinc coating per square foot shall average not less than 3.0 ounces, and no individual specimen shall show less than 2.6 ounces.

High strength bolts and anchor bolts (including nuts and washers) shall be galvanized in accordance with ASTM Designation A153.

Fabrication and galvanizing shall follow ASTM A384 and A385 recommended practice for galvanizing assembled products.

Galvanizing shall be applied after all fabrication has been completed and after all steel has been sand blasted. Welding after galvanizing shall not be permitted.

All holes for field connections shall be reamed while the structure is preassembled in the shop and before members are galvanized.

### BOLTED CONNECTIONS

Nuts for all bolted connections shall be brought to a snug fit only.

# TESTING ORDER

C. S. ID \_\_\_\_\_

Job No. RF 52042/03674A

Attention: Testing and Research Division

Date 8/10/71

Gentlemen:

We have contracted for the purchase of materials for use in the construction of the above project from the firms listed below.

Material	Type & Approx. Qty.	Brand or Dealer	Source of Shipment
<b>CONCRETE MATERIALS</b>			
Cement _____	60 Bbls	Ready Mix	Local
Fine Aggregate _____	20 Cyds	Ready Mix	Local
Coarse Aggregate _____	40 Cyds	Ready Mix	Local
Bar Reinforcement _____	5013 Tons	Phoenix Steel Corp.	Eau Claire, Wis.
Mesh Reinforcement _____			
Structural Steel _____	Gal. Steel 17800 Lbs	Gregory Bridge Co.	Canton, Ohio
Spiral Shear Developers _____			
<b>PIPE CULVERTS, DRAINS &amp; SEWERS</b>			
Reinforced Concrete Pipe _____			
Corrugated Metal Pipe _____			
Cast Iron Pipe _____			
Drain Tile _____			
Vitrified Sewer Pipe _____			
Concrete Sewer Pipe _____			
<b>GUARD RAIL &amp; FENCING</b>			
Posts _____			
Steel Beam Guard Rail _____			
Barbed Wire _____			
Woven Wire _____	Gal. Chain Link 2230 Sft.	To be determined later	
<b>OTHER MATERIALS</b>			
Gravel _____			
Crushed Stone _____			
Joint Material _____			
Joint Sealer _____			
Brick _____			
Waterproofing _____			
Bridge Railing _____			
Treated Timber Piling _____			
Treated Timber & Lumber _____			
Paint _____			
Concrete Curing Material _____			
Bituminous Materials _____			
Deck Grating _____	745 Sft.	Engineered Products, Inc.	Pittsburgh, Pa.
Stairs & Platforms _____	5500 Lbs.	Engineered Products, Inc.	Pittsburgh, Pa.
Luminaires _____			
Standards _____			
Electrical Cable _____			
_____			
_____			
_____			

Contractor A. LINDBERG & SONS, INC. Address 530 Mather Ave., Ishpeming, Mich. 49849

By /s/ Russell LeBlanc

**Note to Contractor:** In order to avoid delay these testing orders (4 copies) should be returned as soon as possible. No tests on materials can be conducted until they are received.

Report No. Post Final & Final

Fabricator's Contract No. \_\_\_\_\_

Date 11-21-71

Shop Inspection of Structural Steel

At Gregory Bridge Co.

C.S. ID.-Job No. RF 8-4 (201) RF 52042 - 03674A

Status of fabrication for period ending \_\_\_\_\_

Date approved drawings received	_____
Estimated tonnage	_____
Material received from mill	_____ 100 %
Material laid out	_____ 100 %
Material fitted and welded	_____ 100 %
No. of radiographs required	_____ ---
No. of radiographs completed and accepted	_____ ---
Material fabricated	_____ 100 %
Material shipped	_____ 100 %

Remarks: The fabrication of this pedestrian bridge was inspected periodically by Mr. Ed Chapman however he neglected to issue reports as required. Weld-in was performed by welders previously qualified by the Dept., material, and workmanship was very good on this structure. Galvanize coating exceeded the minimum and averaged approx. 10 mils. Coating is smooth and exceptionally free of dross. I also inspected complete structure at project site because the load was dumped during shipment and concur in the good quality of fabrication. Only minor damage was done as a result of the accident and straightened at the site. One Inspector \_\_\_\_\_

**DISTRIBUTION:**  
Contractor fabrication error (on one stairway) became apparent during erection  
Federal Highway Administration  
Construction Division and was corrected by the contractor at the fabricators  
District Construction Engineer  
Project Engineer expense. Work was completed by a certified field welder  
Testing & Research File

in relocating the carrier angles under the treads on this stairway.

/s/ Gerald J. Hill



# OFFICE MEMORANDUM



MICHIGAN  
DEPARTMENT OF STATE HIGHWAYS

Crystal Falls, Michigan  
December 28, 1971

To: Earl Numinen  
Project Engineer

From: M. Stockinger  
District #1 Materials Supervisor

Subject: RF52042/03674A

Per the request of Construction Division, an inspection of the galvanizing on the structural components of the above structure was made on December 14, 1971.

Galvanizing on structural steel members averaged 3.53 oz.sq.ft. Galvanizing on deck grating, stairs and platforms averaged 2.5 oz. sq.ft. Thickness determinations were made with Elcometer No.44502.

The above results meet specification requirements.

MS:n  
cc: T & R - Lansing  
R. J. Kirch  
A. J. Marusich

/s/ Mat Stockinger, jr.  

---

District Materials Supervisor

Control Sect. ID RF 52042

Job No. 03674A Federal No. RF 8-4 (201)

Type of Work Pedestrian Bridge

Location US-41 in the Village of Harvey

Contractor A. Lindberg & Sons, Inc.

Date Work Started 9-14-71 Completion Date 7-1-72 Extended to \_\_\_\_\_

Date Work Completed 5-15-72 Anticipated final Estimate Date June 16, 1972

Remarks \_\_\_\_\_

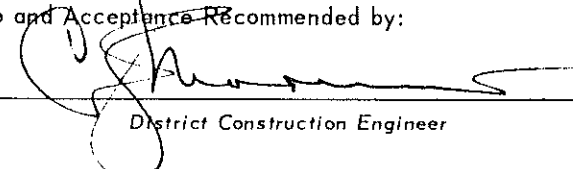
Traffic Maintained ( ) Yes (X) No If answer is no, give date opened to traffic 12-1-71

Final Inspection by F.H.W.A. J. Wesley & W. Jones 5-24-72  
F.H.W.A. Area Engineer Date

Recommended by

_____	_____
Title:	Date
_____	_____
Title:	Date
_____	_____
Title:	Date

This is to certify that the construction work on the captioned project substantially conforms to the plans and specifications as shown by the results of job control sampling and testing. Exceptions to this certification are explained on the back hereof. Certified to and Accepted Recommended by:

  
 \_\_\_\_\_ 5-25-72  
 District Construction Engineer Date

ACCEPTANCE RECOMMENDED \_\_\_\_\_  
 Construction Engineer Date

ACCEPTED

Acceptance Recommended - The Board of County Commissioners

of the County of \_\_\_\_\_

by \_\_\_\_\_  
Title

\_\_\_\_\_  
Chief, Bureau of Operations Engineering

\_\_\_\_\_  
(Date)

\_\_\_\_\_  
(Date)

MICHIGAN DEPARTMENT OF STATE HIGHWAYS 09-27-72  
CONSTRUCTION FINAL

FINAL NO 7 PAGE 1  
KEYE 0400

CON SEC ID RE 52042 PT 01-036754  
JOB NO F0014  
FEDERAL ITEM  
DIST. NO. 1  
ACCOUNT 116-59-8780  
ORGANIZATION  
FEDERAL PROJECT REF-4(201) 511  
WORK TYPE PED BRIDGE OVER USA1  
ROUTE ADM BD APPR 08-03-71

DATE: CONTRACT 08-06-71 COMPL 07-01-72 EXT 07-01-72  
STARTED 09-14-71 WORK COMPLETED 05-15-72  
PROJECT ACCEPTED 05-31-72  
CONTRACTOR A LINDBERG AND SONS INC  
S60 WATHER AVENUE  
ISHPEMING, MICHIGAN 49849

SEND  
CONTRACTORS  
COPY  
CERTIFIED MAIL.

SUBCONTRACTORS

CONTRACT PRICE 43,717.70  
RESERVE THIS ESTIMATE 4295.27  
TOTAL EXTRAS 583.80  
TOTAL REGULAR 43736.90  
TOTAL ADJUSTMENTS 950.00  
TOTAL AMOUNT EARNED 43370.70  
LESS RESERVE  
TOTAL AMOUNT ALLOWED 43370.70  
LESS PREVIOUS PAYMENTS 38657.43  
PAYMENT DUE CONTRACTOR 4713.27

I HEREBY CERTIFY THAT THE FOREGOING ITEMS OF  
WORK INCLUDED FOR PAYMENT ON THIS FINAL  
ESTIMATE HAVE BEEN PROPERLY COMPLETED.

PROJECT ENGINEER

DATE

I HEREBY CERTIFY THAT THE FINAL QUANTITIES INCLUDED FOR  
PAYMENT IN THIS ESTIMATE HAVE BEEN REVIEWED AND  
CHECKED FOR ACCURACY IN ACCORDANCE WITH CURRENT  
PUBLISHED INSTRUCTIONS

DISTRICT CONSTRUCTION ENGINEER

DATE

REVIEWED AND APPROVED FOR PAYMENT.

CONSTRUCTION ENGINEER

DATE

I HEREBY CERTIFY THAT ALL ARITHMETICAL COM-  
PUTATIONS HAVE BEEN VERIFIED AND THAT THE  
UNITS OF WORK FOR WHICH PAYMENT IS BEING  
MADE HAVE BEEN AUTHORIZED.

CONTRACT PAYMENT UNIT SUPERVISOR

DATE