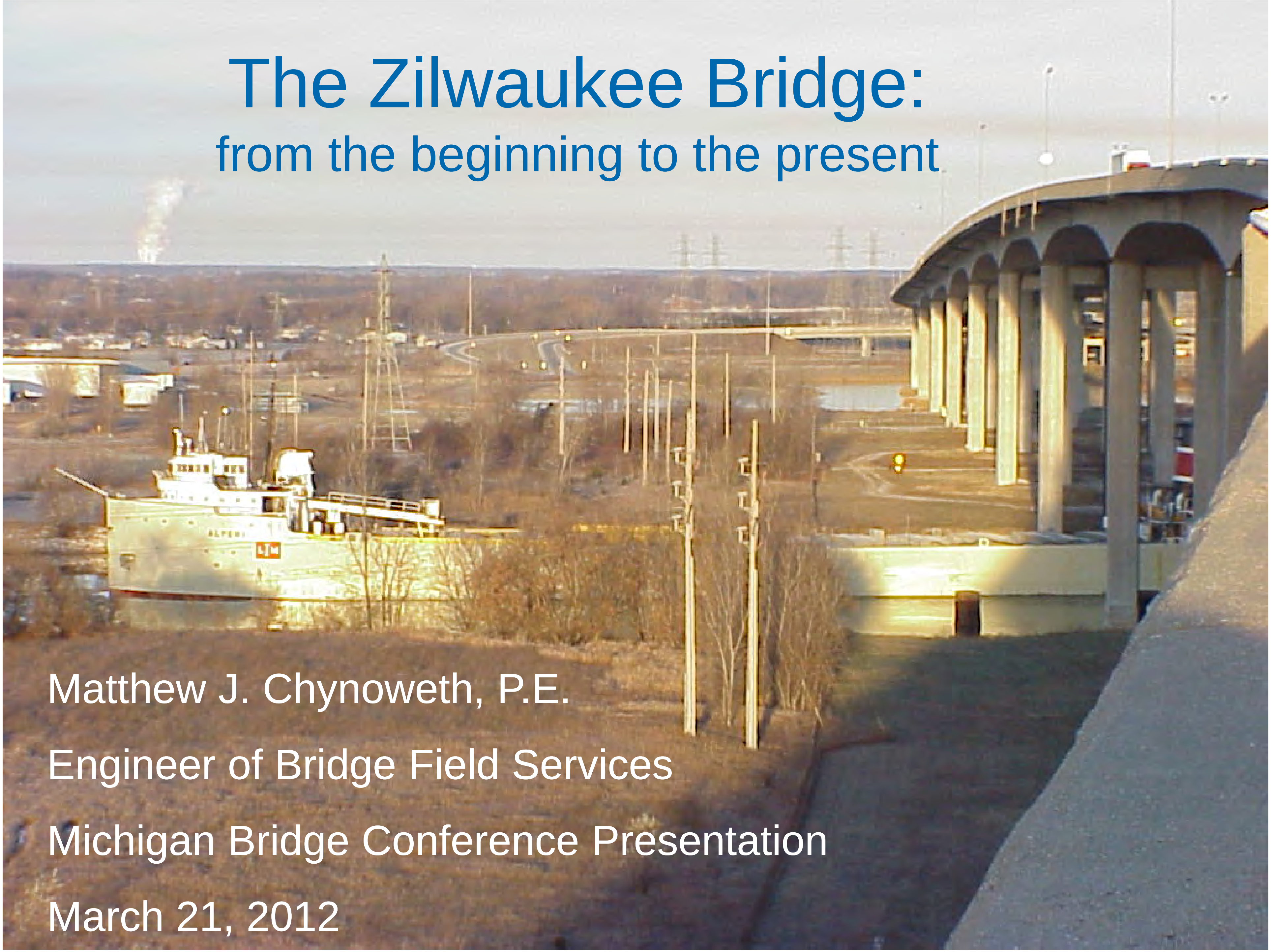


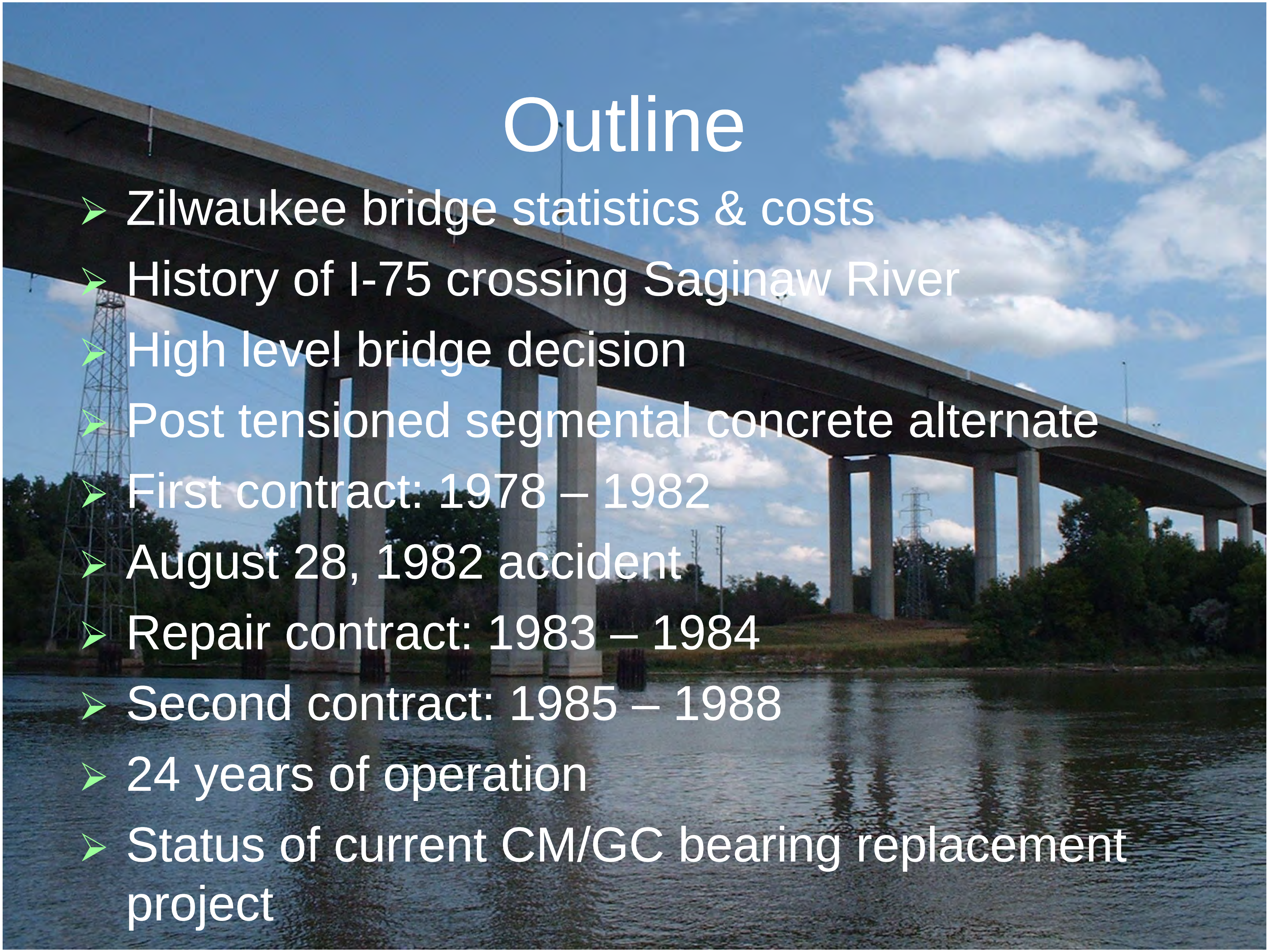
The Zilwaukee Bridge:
from the beginning to the present

Matthew J. Chynoweth, P.E.

Engineer of Bridge Field Services

Michigan Bridge Conference Presentation

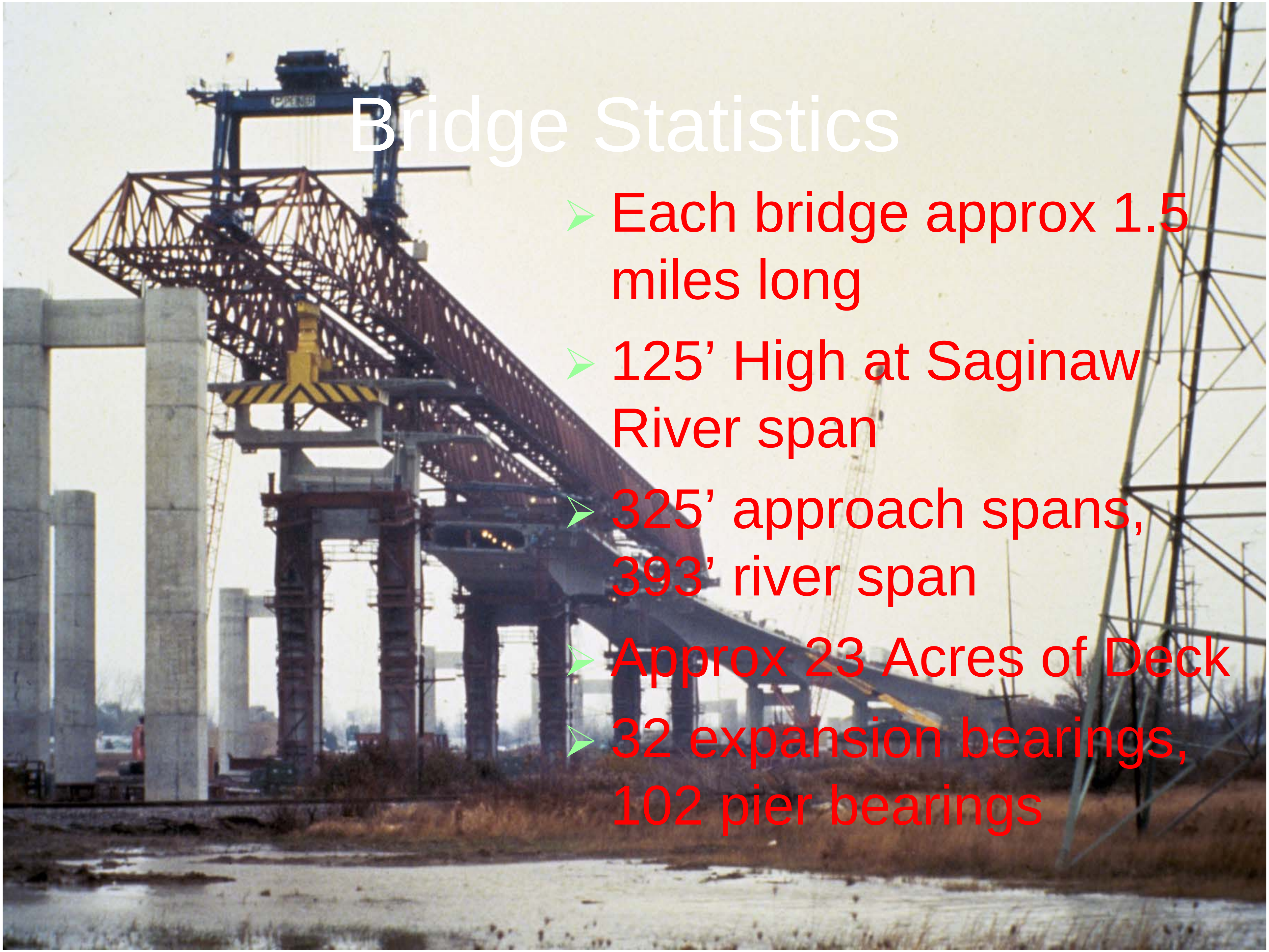
March 21, 2012



Outline

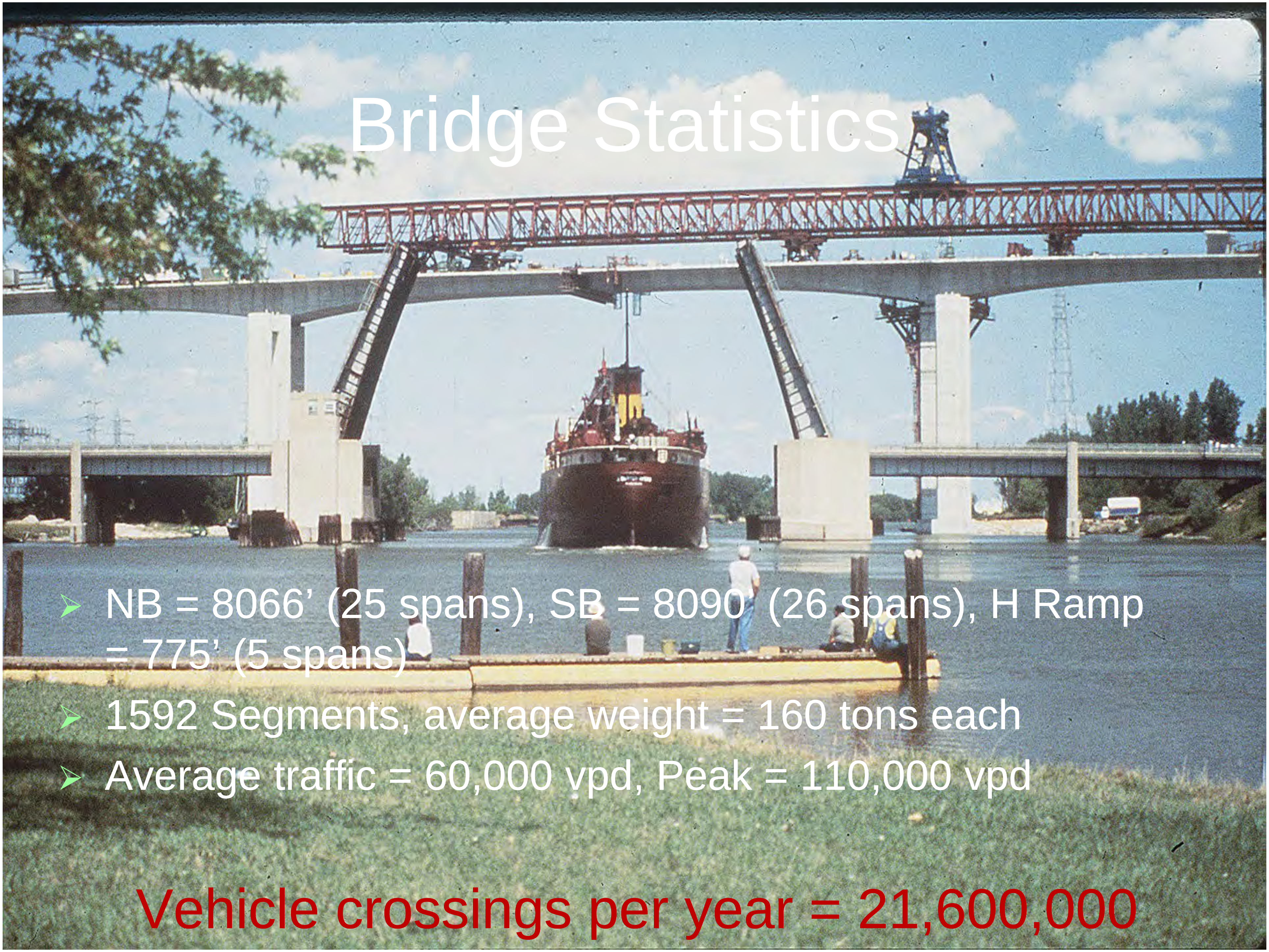
- Zilwaukee bridge statistics & costs
- History of I-75 crossing Saginaw River
- High level bridge decision
- Post tensioned segmental concrete alternate
- First contract: 1978 – 1982
- August 28, 1982 accident
- Repair contract: 1983 – 1984
- Second contract: 1985 – 1988
- 24 years of operation
- Status of current CM/GC bearing replacement project

Bridge Statistics



- Each bridge approx 1.5 miles long
- 125’ High at Saginaw River span
- 325’ approach spans, 393’ river span
- Approx 23 Acres of Deck
- 32 expansion bearings, 102 pier bearings

Bridge Statistics



- NB = 8066’ (25 spans), SB = 8090’ (26 spans), H Ramp = 775’ (5 spans)
- 1592 Segments, average weight = 160 tons each
- Average traffic = 60,000 vpd, Peak = 110,000 vpd

Vehicle crossings per year = 21,600,000

Bridge Construction Costs

- Low Bid $77 Million in 1979
- First contract – $75 million (1979 – 1982)
- Repair contract – $6 million (1983 – 1984)
- Second contract – $38 million (1985 – 1988
- Final Cost $120 Million in 1989

Bridge Maintenance Costs

- General Maintenance:
  - Equipment & Facilities = $685,000
  - Bridge crew salaries & benefits = $360,000/year
- Winter operations = $600,000/year
- Epoxy injections = $5.6 million over 7 years
- Inspections = $30,000 every 2 years
- Detailed inspections = $800,000 every 4 years

23 year operating cost = $1.45 million/year

Bridge Rehabilitation Costs

- 1995 Pier 17 N Strengthening = $500,000
- 2002 Modular Joint Replacement = $4.5 million
- 2007 Expansion Bearing Replacement = $3 million (no bearings replaced)
- 2013-2014 Bearing replacement, overlay & bridge barrier repairs = $35 million (estimated cost)

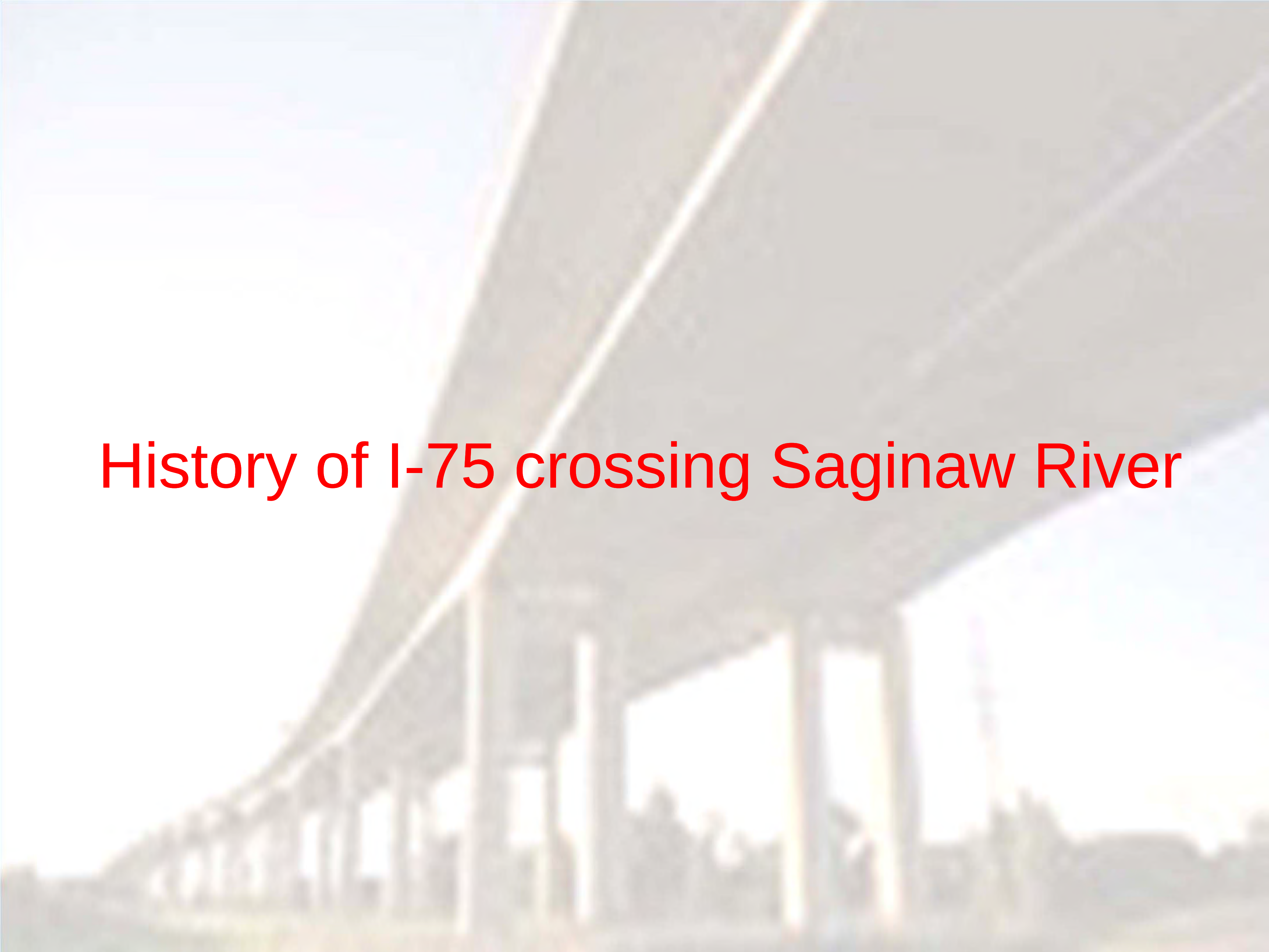
23 year rehabilitation costs = $43 million

Total Costs

- $120 million original construction
- $1.45/million per year in maintenance and inspection
- $43 million in past & planned rehab

This asset represents a major capital and resource investment on a continual basis

Given the impact on the economy and mobility this structure has, the investment is justified

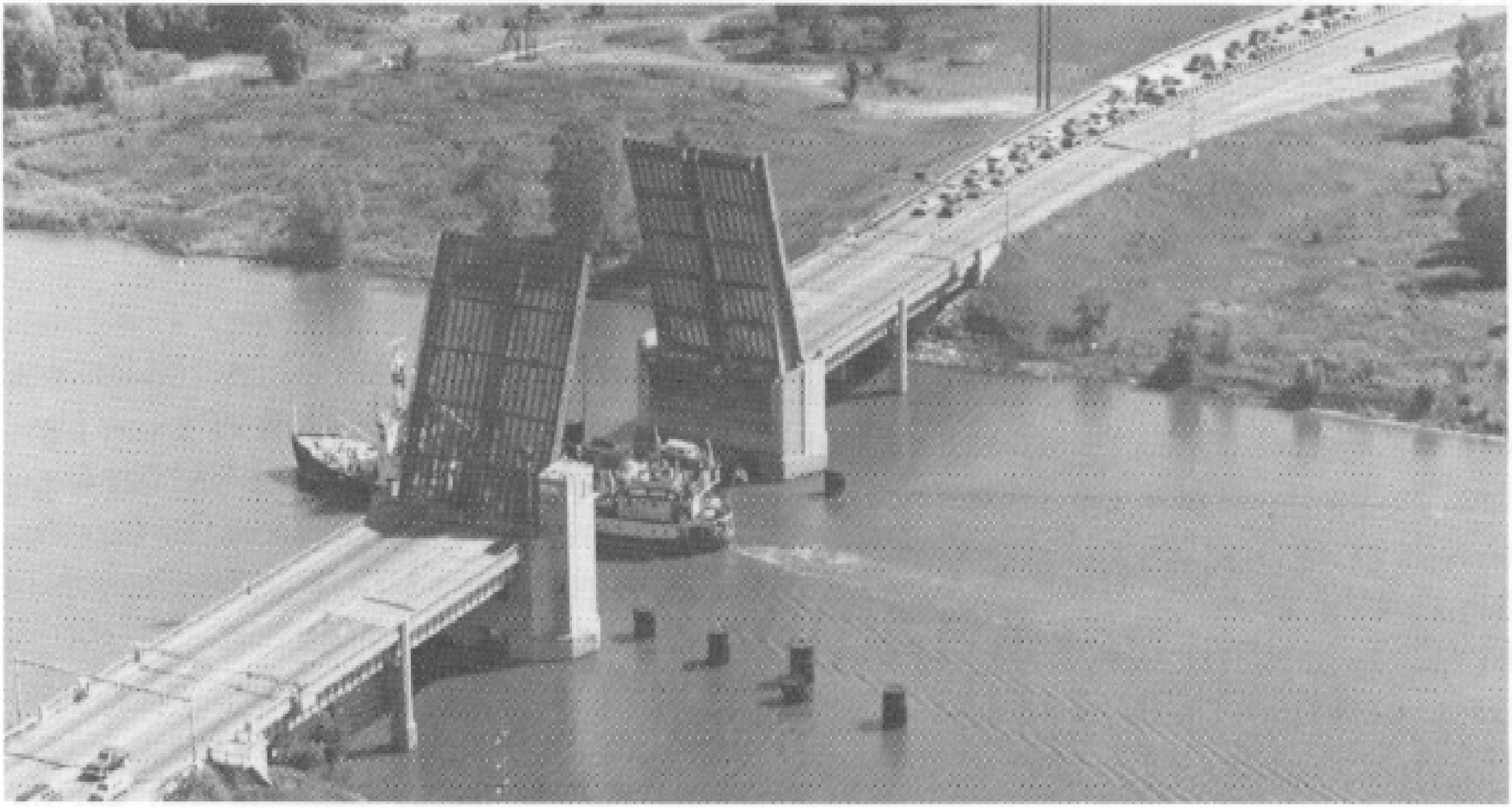


History of I-75 crossing Saginaw River

History of I-75 crossing Saginaw River

- Built in 1960, the existing bascule bridge carried two lanes of I-75 NB and I-75 SB over the Saginaw River

History of I-75 crossing Saginaw River



Opening of the existing drawbridge causes long traffic back-ups and accidents.

History of I-75 crossing Saginaw River

History of I-75 crossing Saginaw River

- October 5, 1967 collision of the J.F. Schoelkopf

History of I-75 crossing Saginaw River

- From 1973 –1975, I-75 was widened from Flint to north of Bay City, with the exception of this corridor

- At the time, was the only bascule bridge on I-75 interstate from Florida to Upper Peninsula

- Capacity was exceed by mid to late 1960's, planning for alternate crossing was approved in 1970

- Options considered:

    - Tunnel under river
    - Widen I-675 and abandon existing I-75 alignment
    - Close Saginaw River to large vessel navigation at Zilwaukee
    - High level bridge

History of I-75 crossing Saginaw River

- Bascule bridge annual openings peaked at 984 in 1978, and decreased to 417 in 1982

- Shortly before the high level bridge opened, the large Army Corps of Engineers dredging vessel ceased operations in the Saginaw River

- General Motors Central Foundry Division decreased river deliveries by 90%

High Level Bridge Decision

High Level Bridge Decision

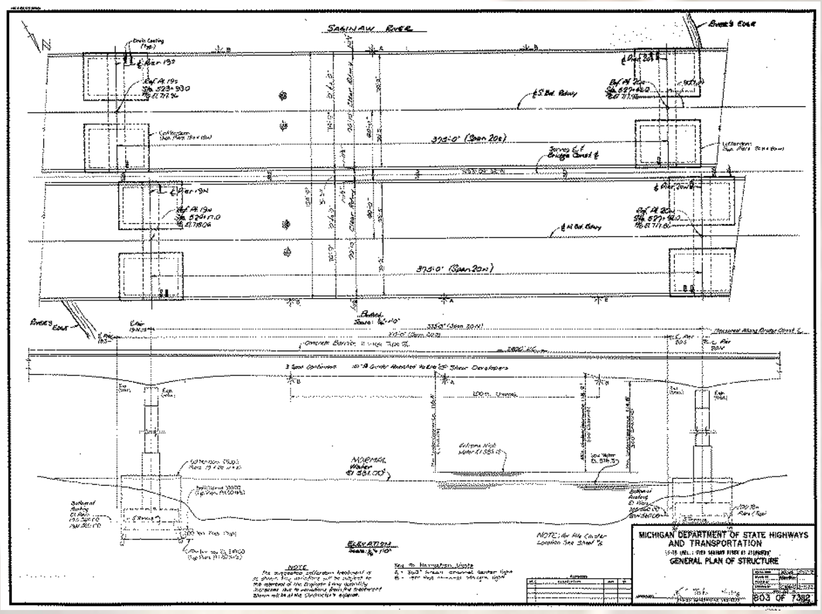
- Of the various options considered in the EIS, the high level bridge options was considered the most economically feasible.
  - Smallest impact on existing I-75 traffic
  - Did not require large ROW acquisitions within the developed portions of the City of Saginaw for I-675 capacity improvement
  - Did not require closure of the Port of Saginaw
  - Until mid 1970's, MDOT's long range plan included abandoning the existing I-75 alignment, and re-routing southwest of City of Saginaw where river is not navigable. This idea was eventually dropped due to cost

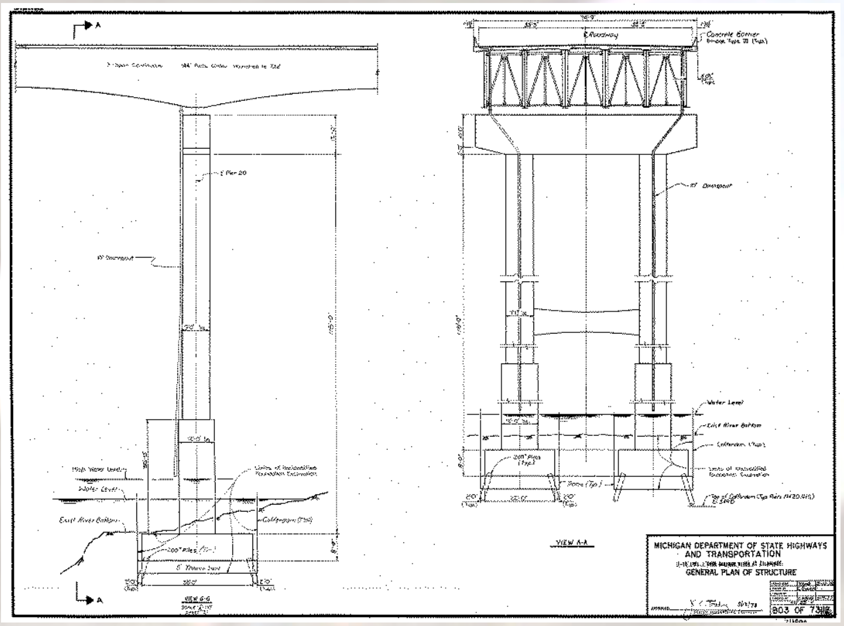
High Level Bridge Decision

- Environmental Impact Statement for high level bridge was signed by FHWA in November 1974

- In 1976, plans for a 37 span steel plate girder bridge were submitted to FHWA.

  - 84”, 108”, and 144” haunched to 216” depths





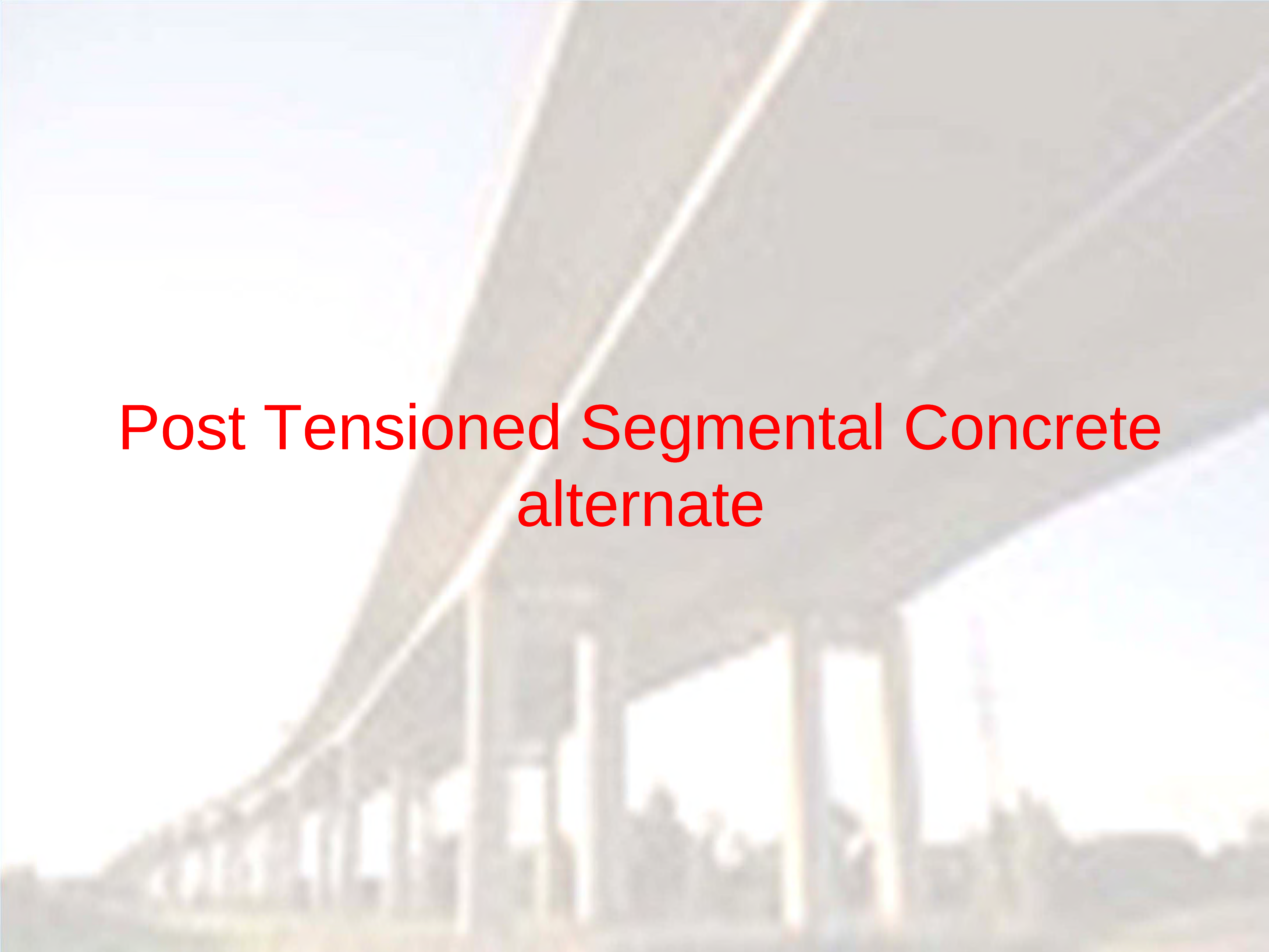
High Level Bridge Decision

- Plan development and approval process was lengthy
  - MDOT focused on steel options
  - In 1973, MDOT contracted a structure study for concrete alternative, but decided to proceed with only steel option in 1974
- FHWA questioned the approach and river span lengths and girder depths with respect to economy
- Value engineering was not enforced at this time
- FHWA policy at the time required alternate designs on major projects to foster competitive bidding

High Level Bridge Decision

- FHWA requested changes to steel design, and required concrete alternate
- MDOT hired BVN/STS to design a concrete alternate in November 1977
- Final plans for both options were submitted for bidding in September 1978

Post Tensioned Segmental Concrete alternate



Segmental Concrete alternate

- While prevalent throughout post World War II Europe, post tensioned segmental concrete structures were in their infancy in the U.S. in the 1970’s

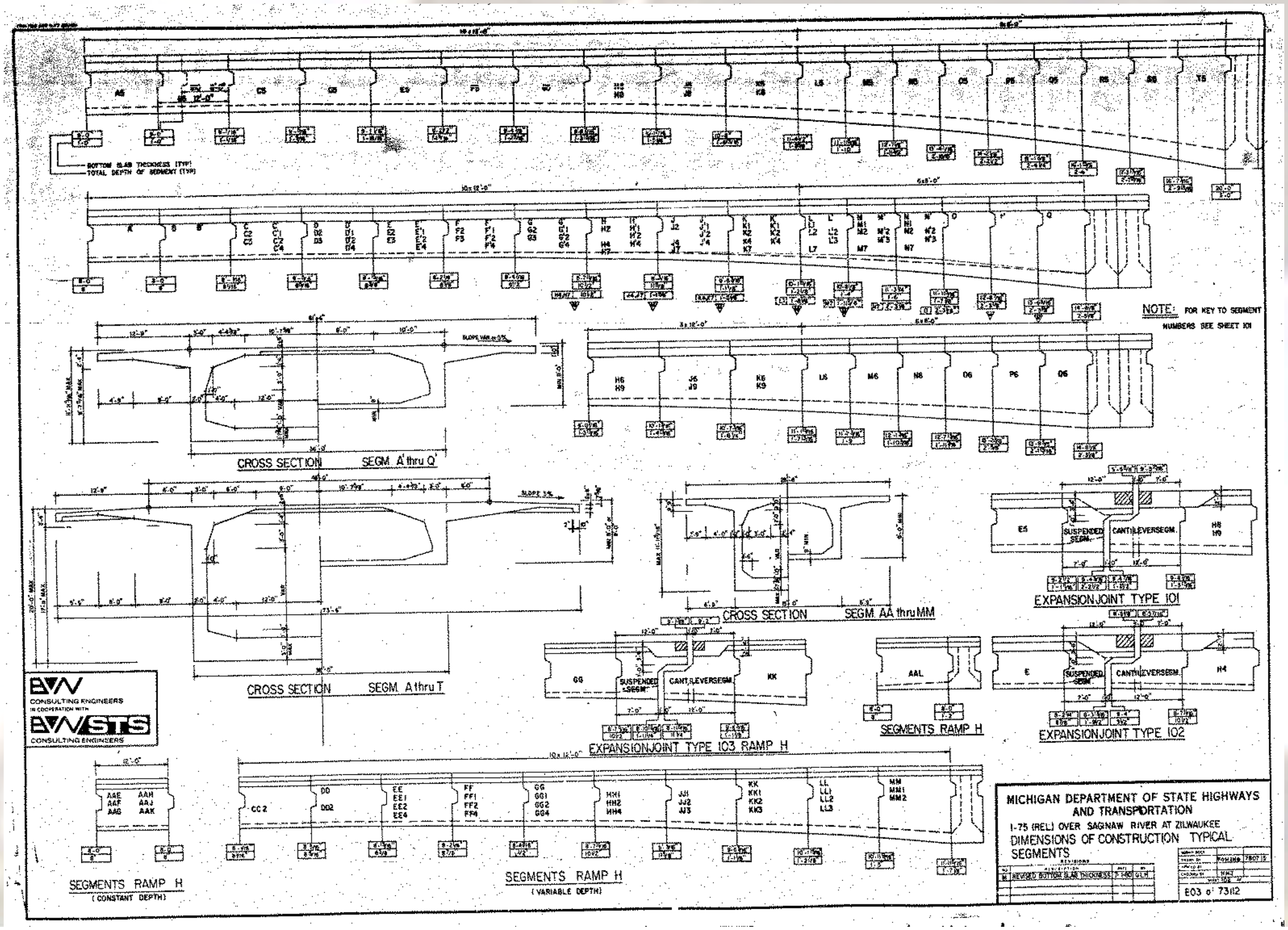
- Balanced cantilever construction required strict erection procedures, produced construction loads often exceeding service loads, require jacking and shoring towers, temporary prestressing and post tensioning to control erection stresses

- Designed using StarDyne (NASA) finite modeling software, erection sequence analyzed with BRUCO (BRidge Under COnstruction) staged and time dependent construction software

- Large single web shear keys, quarter point hinges, and longitudinal crack formation in anchorage zones were common issues on these “Generation 1” segmental structures

Segmental Concrete alternate

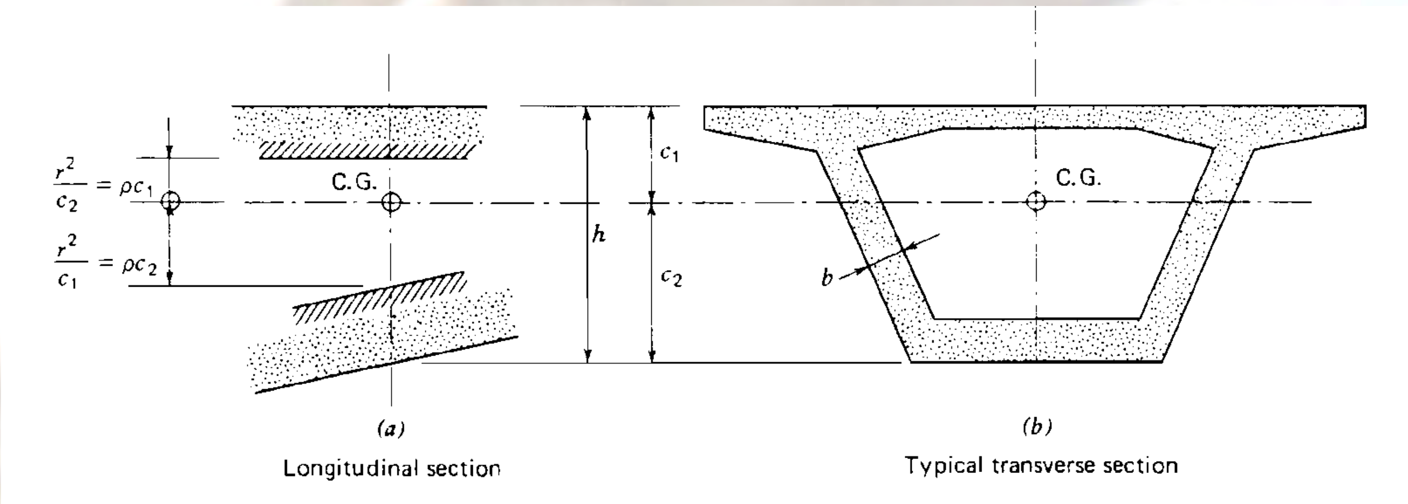
- One of the largest single cell segmental box girders in the U.S. at the time of construction



Segmental Concrete alternate

- Cantilever wing lengths are designed to balance transverse positive and negative moments depending on placement of live load

- Box section design is optimized to produce moments of inertia and tendon eccentricities to sufficiently minimize section stresses during balanced cantilever erection (S_t), and longitudinal service conditions (S_b)



Segmental Concrete alternate

- Cantilever and continuity tendons consist of 12 – 0.5” diameter 7 wire 270 ksi strands
  - f_s = 496k
  - Stressed to $0.8*f_s$ = 396k
  - Maximum force at service = $0.7*f_s$ = 347k
- Transverse tendons originally consisted of 10 – 0.5” diameter 7 wire 270 ksi strands, but were changed to 12 strands due to wing cracking during load tests
- Expansion hinge segments required vertical prestressing bars, and segments were to be temporarily fixed with continuity tendons to facilitate balanced cantilever construction
- Concrete compressive strength = 5500 & 6000 psi

Segmental Concrete alternate

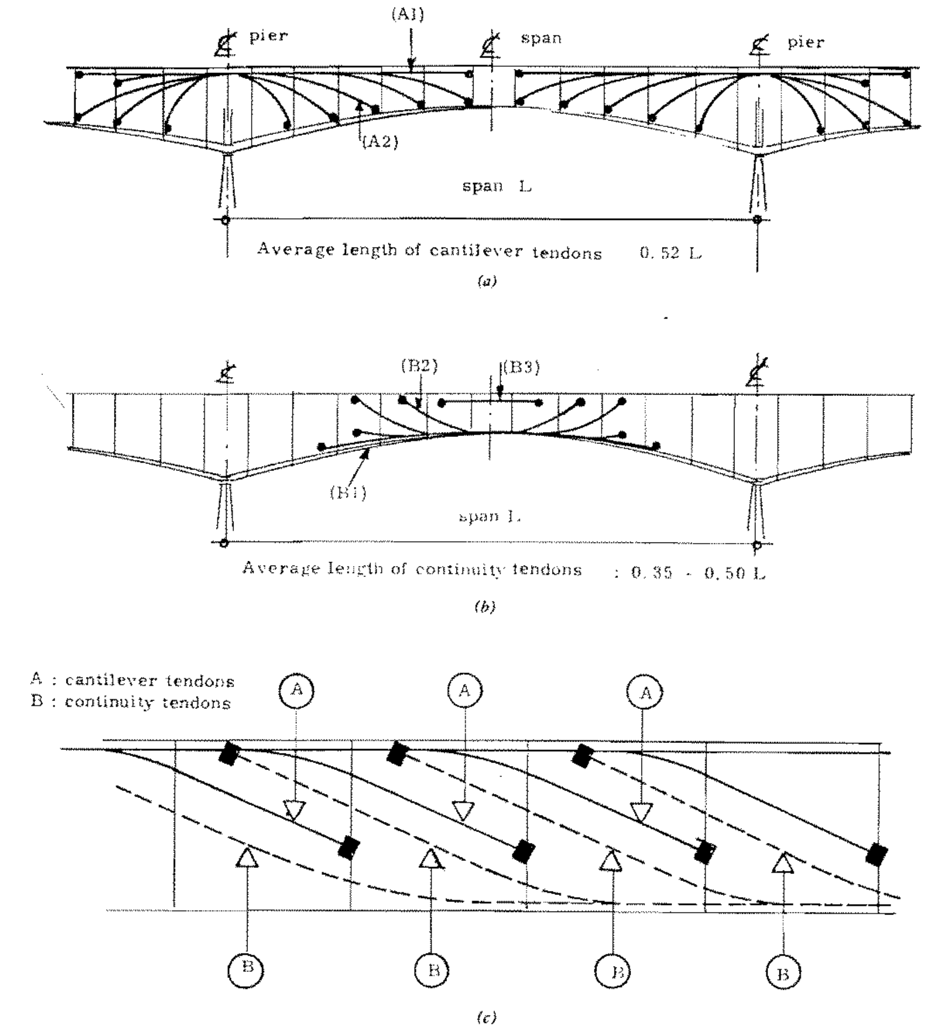
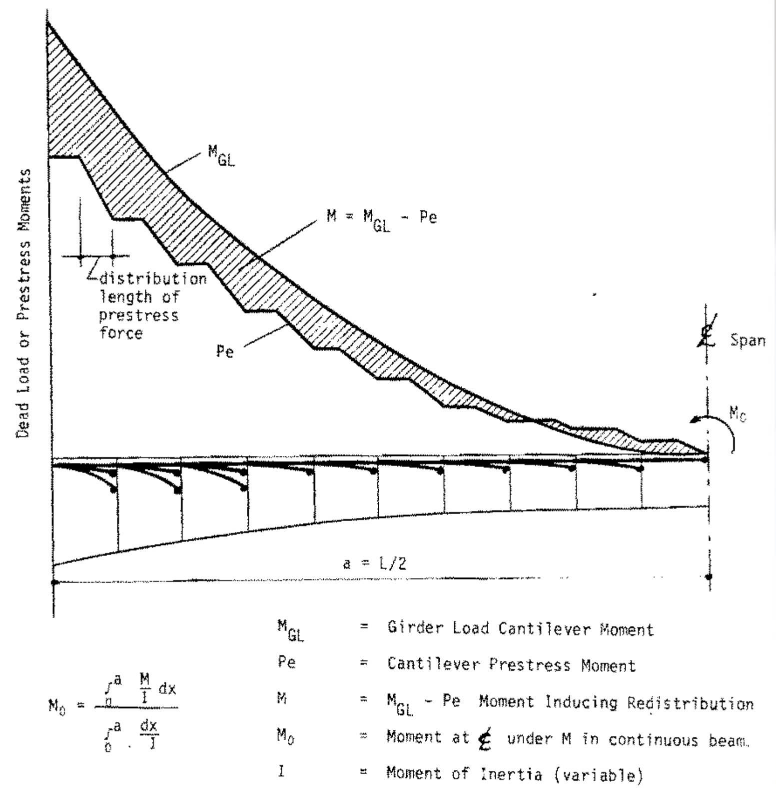


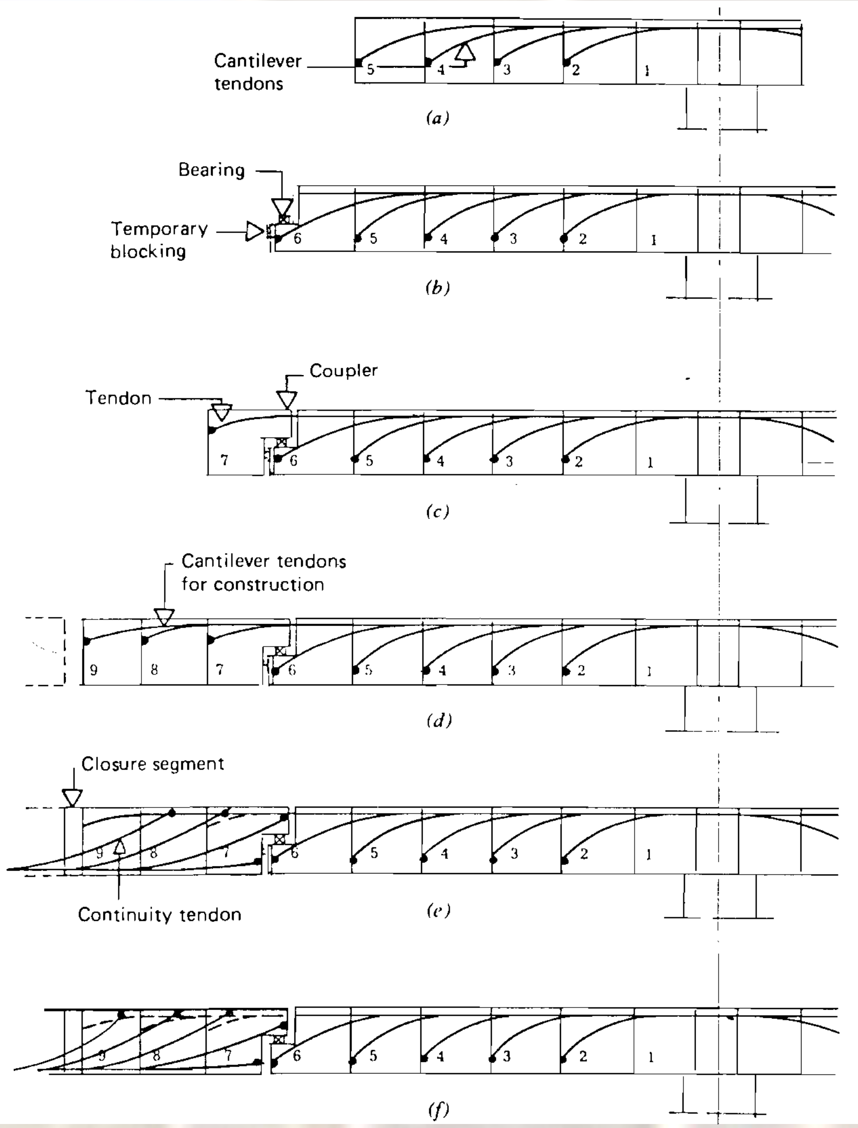
FIGURE 4.31. Typical layout of longitudinal prestress. *(a)* Cantilever tendons. *(b)* Continuity tendons. *(c)* Standardized layout of tendons for constant-depth segments.



$$M_0 = \frac{\int_0^a \frac{M}{I}\,dx}{\int_0^a \frac{dx}{I}}$$

- Typical tendon layout, and design complexity

Segmental Concrete alternate



- Tendon layout and procedure for expansion hinges

Segmental Concrete alternate

- Structure was designed for future 2.52 k/lf (35 psf) future wearing surface that will never be applied
- Designed for +11 degree and -9 degree temperature gradient between top and bottom slabs
- Designed for cantilever loads of 20k at the end of erected segment, and 500k launching girder reaction 18' from end of cantilever
- Allowable concrete service stresses:
    - Compression = 400 psi
    - Tension
        - 0 psi longitudinal
        - 220 psi transverse – no tension under dead load

Segmental Concrete alternate

- Original design assumed a 650’ launching girder
- Contractor proposed a 960’ launching girder in order to erect two cantilever is succession prior to launching into the next position
- Modifications were made to the box section that included thicker bottom slabs and additional cantilever and continuity tendons
- Modifications were also made to piers and pier footings due to larger unbalanced moments from launching girder

First contract: 1979 – 1982

First contract 1979 – 1982

- Project let in September 1978
    - Low bid for steel = $85.6 million
    - Low bid for concrete = $81 million
- The engineer’s estimate was $61 million
- MDOT cited a poor initial engineer’s estimated, and requested FHWA to award bid
- FHWA rejected all bids based on recent anti-inflation legislation on federal aid projects, and requested changes be made, and the project re-let

First contract 1979 – 1982

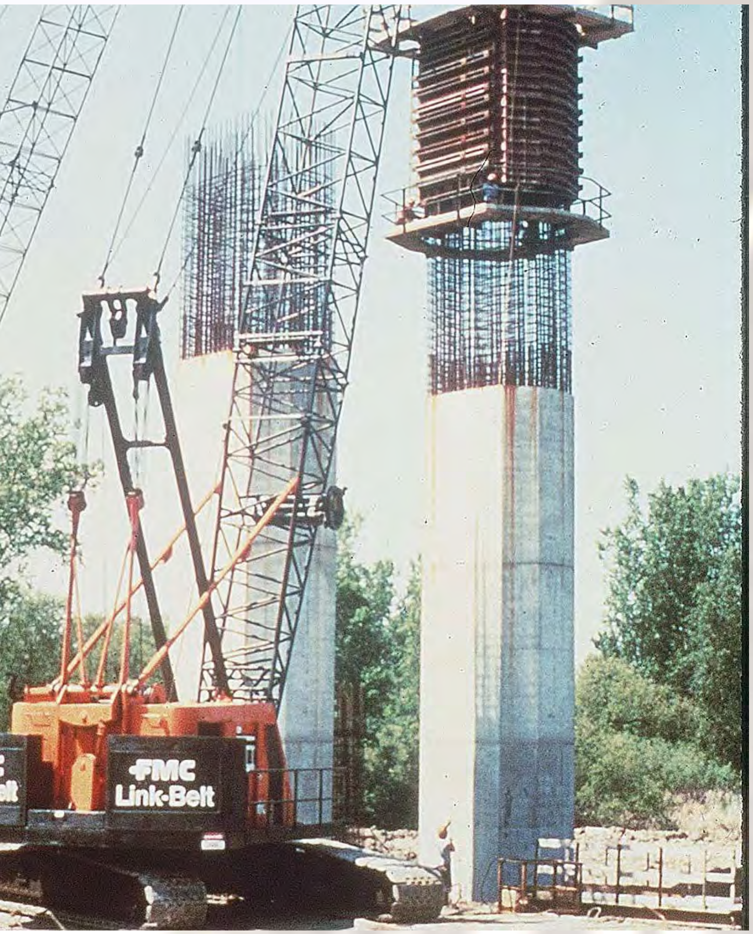
- The following changes were made:
  - Addition of a clause allowing the contractor to receive half of the savings realized from redesigns
  - Incentive/disincentive clause for $3,000 per day for early completion, or delayed completion
  - Price adjustment clauses for steel and cement materials, along with fuel costs tied to a published index to reduce the contractor's risk of price increases

First contract 1979 – 1982

- Project was re-let in August 1979
  - Low bid for steel = $86.2 million
  - Low bid for concrete = $76.8 million
- Project was awarded to Stevin/Toebe joint venture in September 1979
- 3 years after planned start of construction date
- Project was originally scheduled to be complete by November 1983
- Construction commenced in October 1979

First contract 1979 – 1982

First contract 1979 – 1982

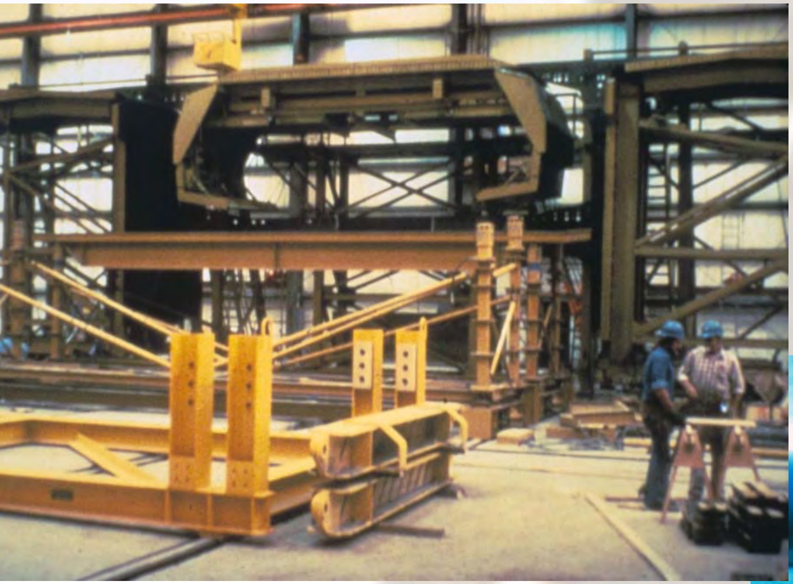


- Pier construction

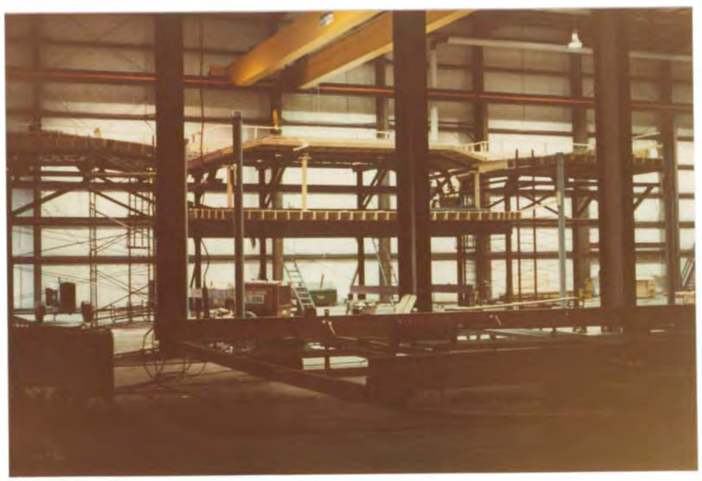
First contract 1979 – 1982



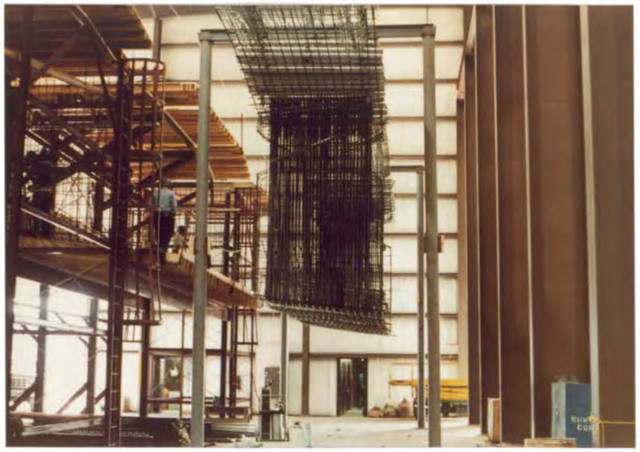

First contract 1979 – 1982



First contract 1979 – 1982



First contract 1979 – 1982



First contract 1979 – 1982

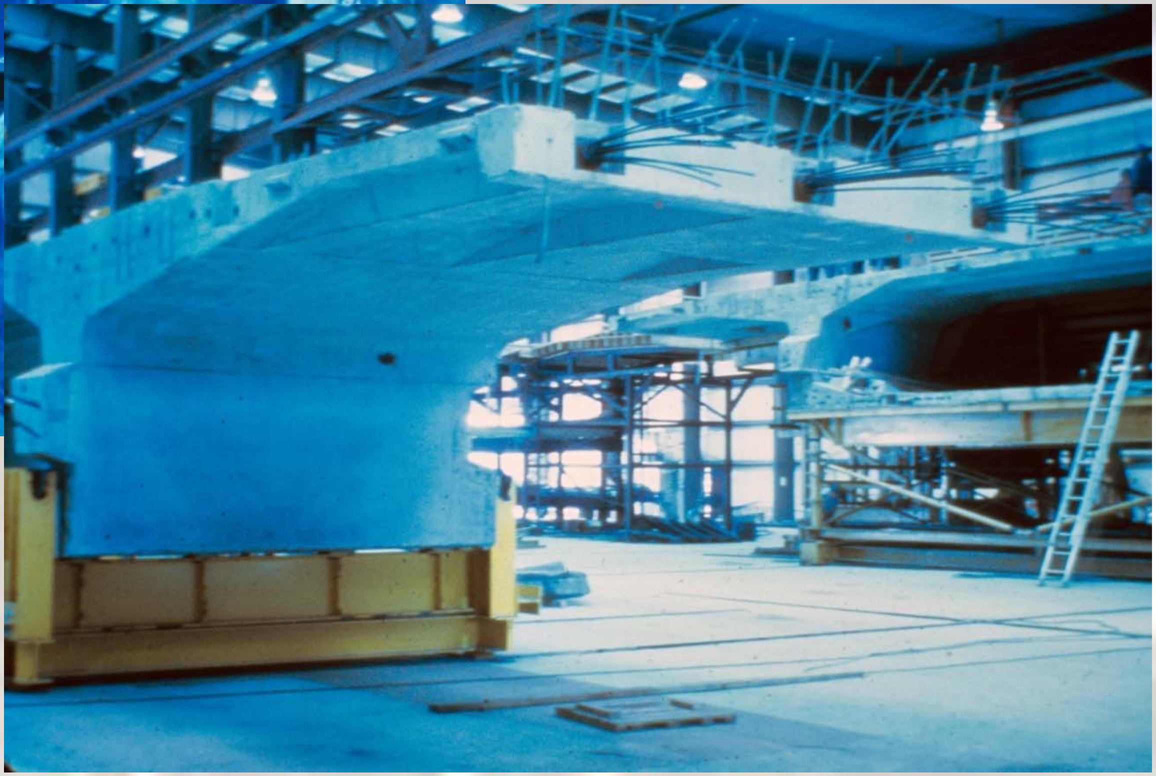
First contract 1979 – 1982

- Segment casting – short line match casting

First contract 1979 – 1982

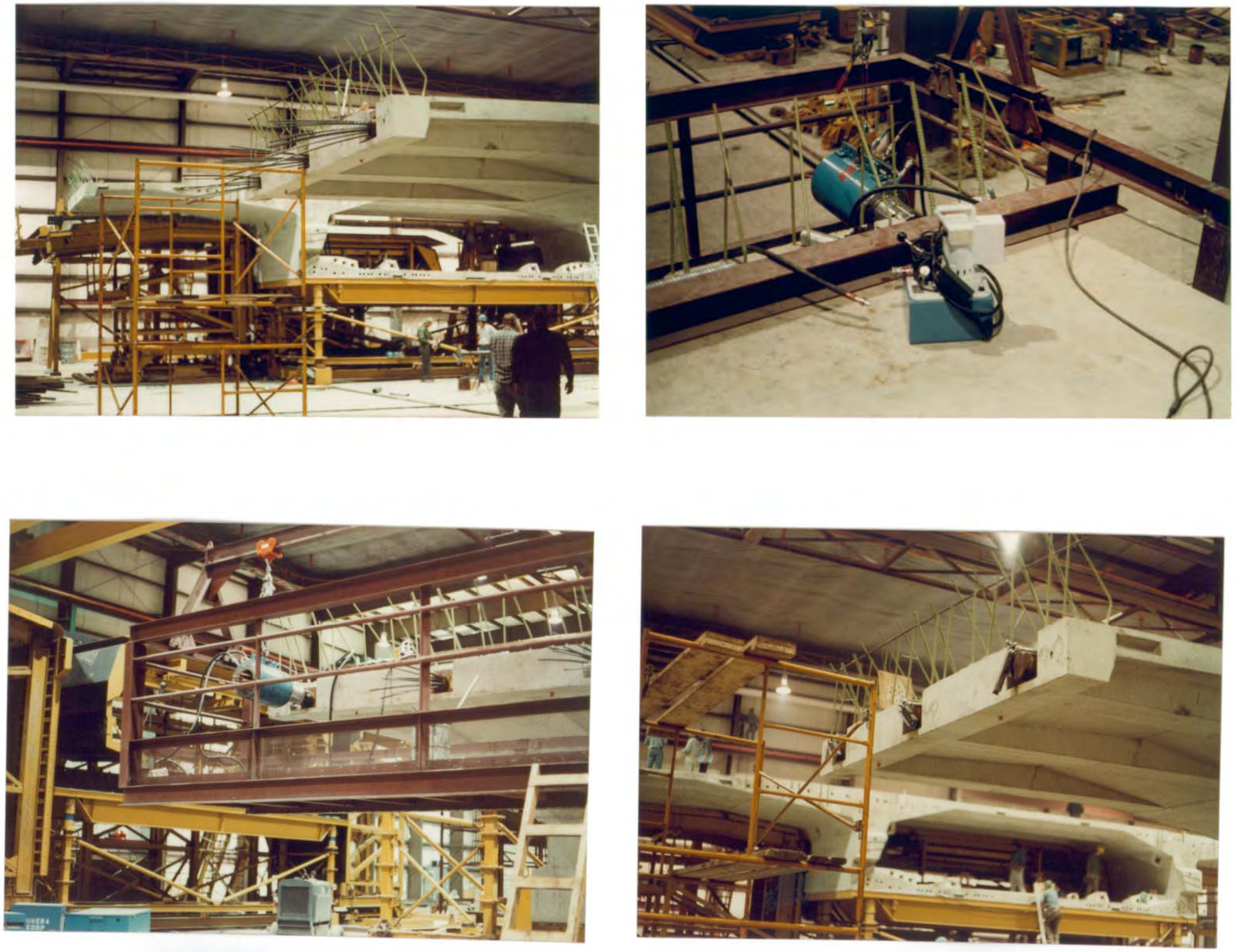
- Segment casting – steam cured, move to PT stage

First contract 1979 – 1982



- Segment casting – transverse PT stressing

First contract 1979 – 1982



- Segment casting – transverse PT stressing

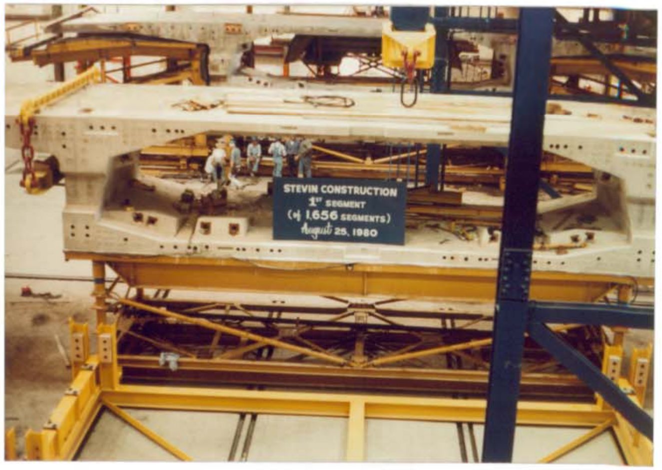
First contract 1979 – 1982

- Segment casting – draped PT stressing of pier diaphragms

First contract 1979 – 1982

- Segment casting – segment wing load test

First contract 1979 – 1982



- Segment casting – 1st segment complete, August 25, 1980

First contract 1979 – 1982

- Segment casting – segment storage yard

First contract 1979 – 1982

- Segment erection– 1st segment set, Pier 25N

First contract 1979 – 1982

First contract 1979 – 1982

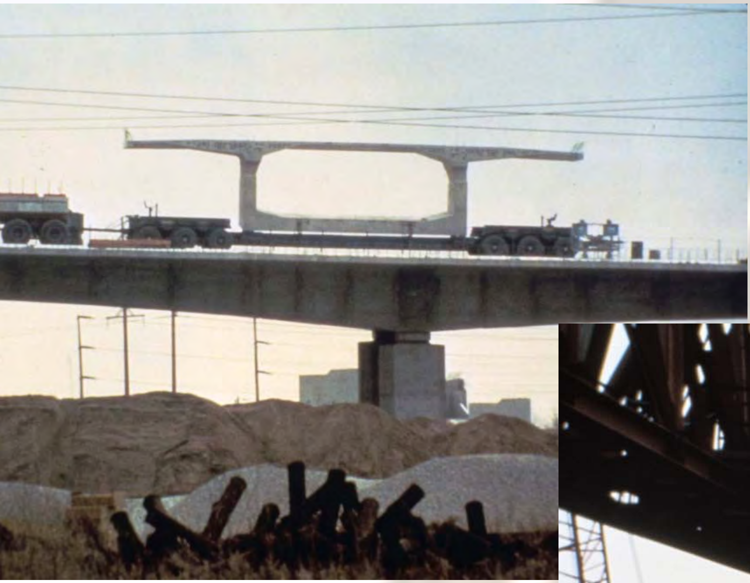
First contract 1979 – 1982

First contract 1979 – 1982

First contract 1979 – 1982

First contract 1979 – 1982

First contract 1979 – 1982



First contract 1979 – 1982

First contract 1979 – 1982

- Segment erection – temporary PT and epoxy

First contract 1979 – 1982

- Segment erection – alignment and strand stressing

First contract 1979 – 1982

- Segment erection – cast in place closure pour

First contract 1979 – 1982

- Segment erection – cast in place closure pour

First contract 1979 – 1982

- Segment erection – expansion hinges

First contract 1979 – 1982

- Segment erection – expansion hinges, compression blocks

First contract 1979 – 1982

- Segment erection – continuity tendons

First contract 1979 – 1982

- Construction progress in summer of 1982

August 28, 1982 Construction accident

August 28, 1982 Construction Accident

- Shortly after midnight on August 28, segment 10NSG was delivered by the segment hauler to the gantry
- The gantry began moving south, when sudden and large displacements of the 11NS cantilever resulted in a downward deflection of roughly 5’-3”, and the expansion joint in span 12 deflected upward by 3’-6”
- 1200 k – 1500 k horizontal forces tilted Pier 11N 9” to the north until the northerly pile group failed in tension, cracking the footing from top to bottom
- Equilibrium was reached when the Pier 11N footing became a spring due to lack of EI, and the launching girder stiffness drew in load, effectively becoming a strut, stabilizing the overall structural system

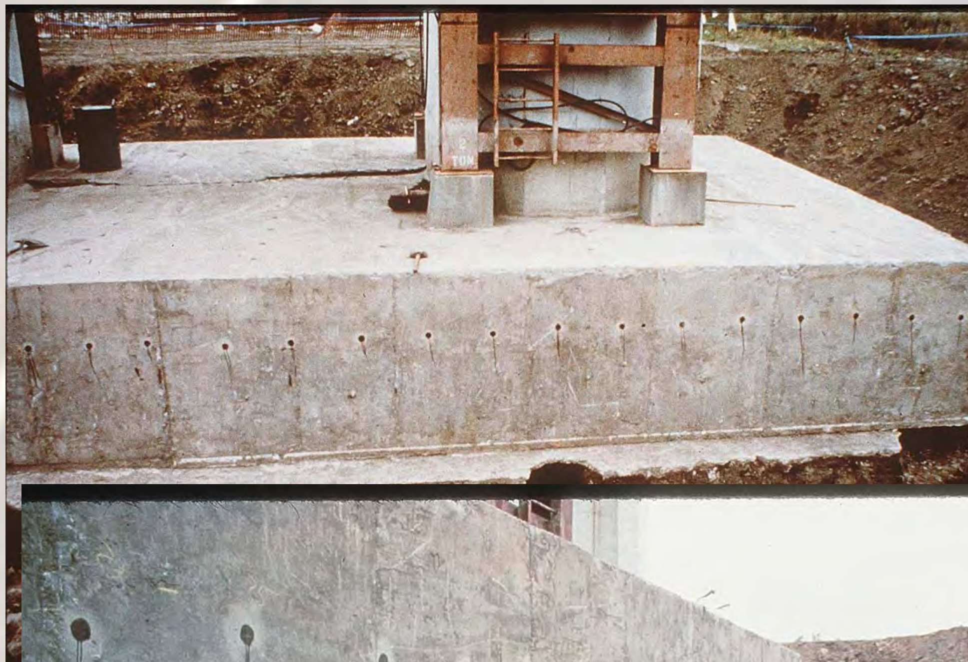
August 28, 1982 Construction Accident

- Rotation of cantilevers 11N & 11S

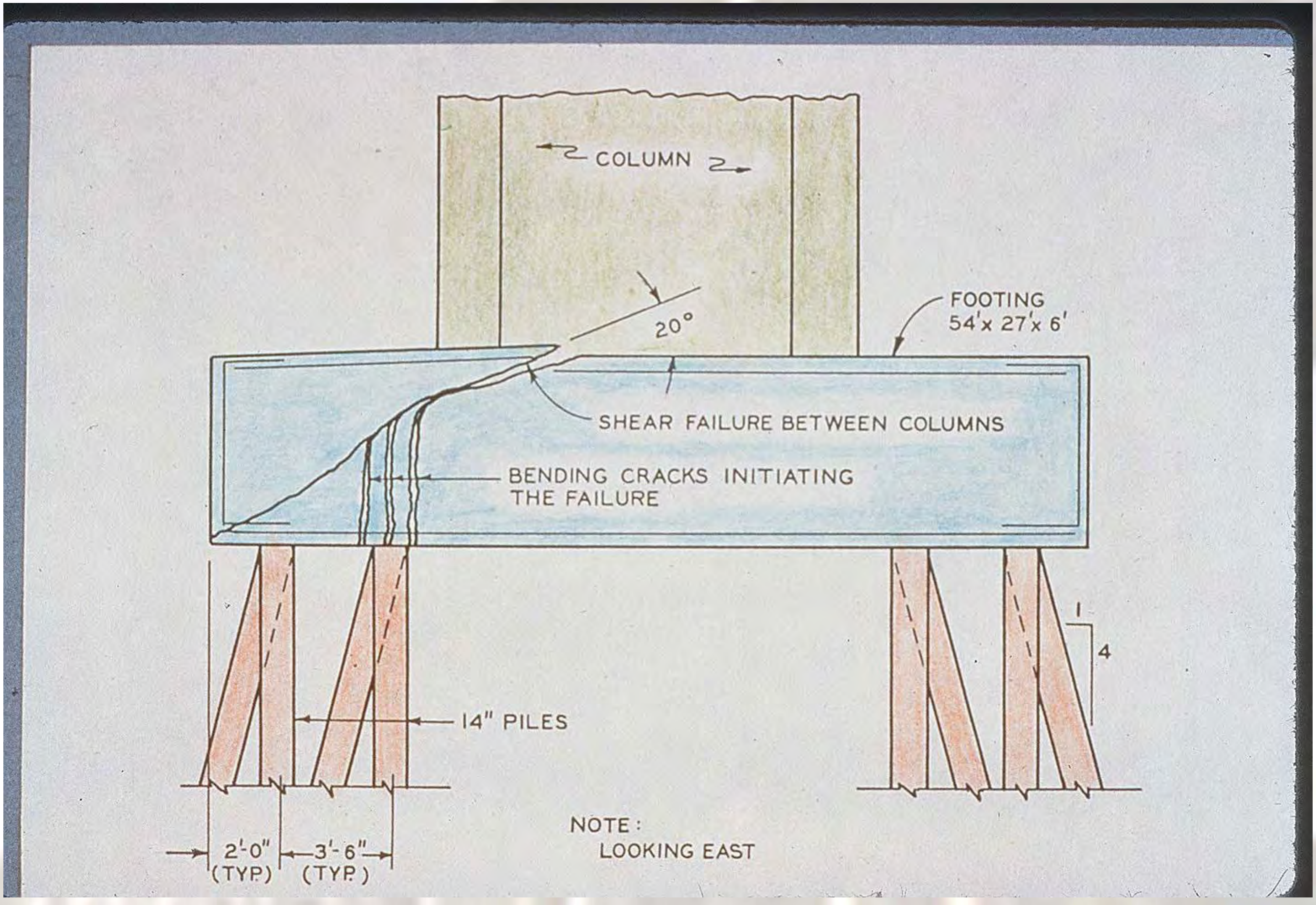
August 28, 1982 Construction Accident

August 28, 1982 Construction Accident

August 28, 1982 Construction Accident



ugust 28, 1982 Construction Accident



August 28, 1982 Construction Accident

- Fixity at Span 12 expansion joint provided by 24 – 12 strand tendons (changed from design of 30 strands) and six 18” x 24” spacer blocks in the top flange to pre-compress the joint in the top slab, and an 8” full width spacer block across the joint in the bottom slab

- Temporary continuity tendons were ungrouted, and thus free to elongate with increased load

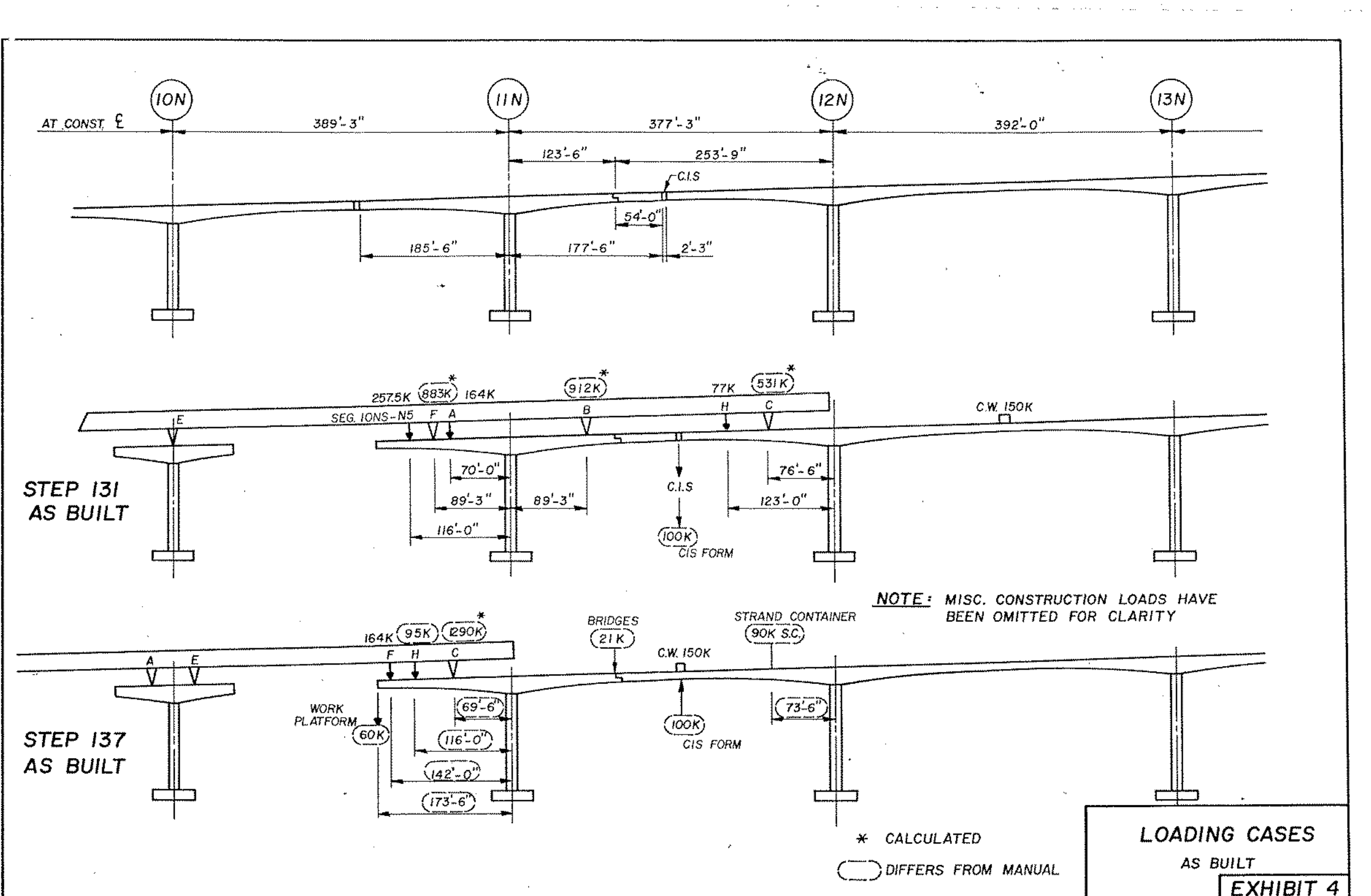
- Expansion joints 22, 19, 17 and 14 previously constructed, were north of the direction of erection, seeing less negative moment due to erection forces, joint 12 was the first joint south of the Saginaw River, so erection loads on cantilever 11S created large negative moments in the joint.

- Actual bending moments in joint 12 were calculated to be

August 28, 1982 Construction Accident

- Construction was out of sequence, some segments were erected before the girder was to move to next position
- The work platform (60 kips) at the end of segment 11NSC was supposed to be removed, but was left in place
- The actual position and reactions of launching girder support legs differed from positions outlined in the erection procedures
- Factor of safety for construction loads for erection procedure was determined to be 1.0

ugust 28, 1982 Construction Accident



August 28, 1982 Construction Accident

- Locked in moments from changing the statical system (closure pour), and positive continuity tendon stressing create large moments on expansion joint

- Launching girder support leg locations were critical to counter act positive moment in expansion joint due to loaded segment hauler travel

- Excessive rotations disengaged the top compression blocks, allowing ungrouted tendons to elongate

- Failure of the bottom compression blocks was a result of excessive rotation due to loading on the cantilever causing edge loadings exceeding compressive strength of concrete

August 28, 1982 Construction Accident

- MDOT and Stevin/Toebe Joint Venture mutually agreed to terminate the contract in 1983
- MDOT bought the launching gantry, segment casting facility and all other equipment, Stevin/Toebe agreed to drop $25 million in claims up to that point
- FHWA agreed to the contract termination, and fully participated in all costs
- Next step was to let a repair contract

Repair contract: 1983 – 1984

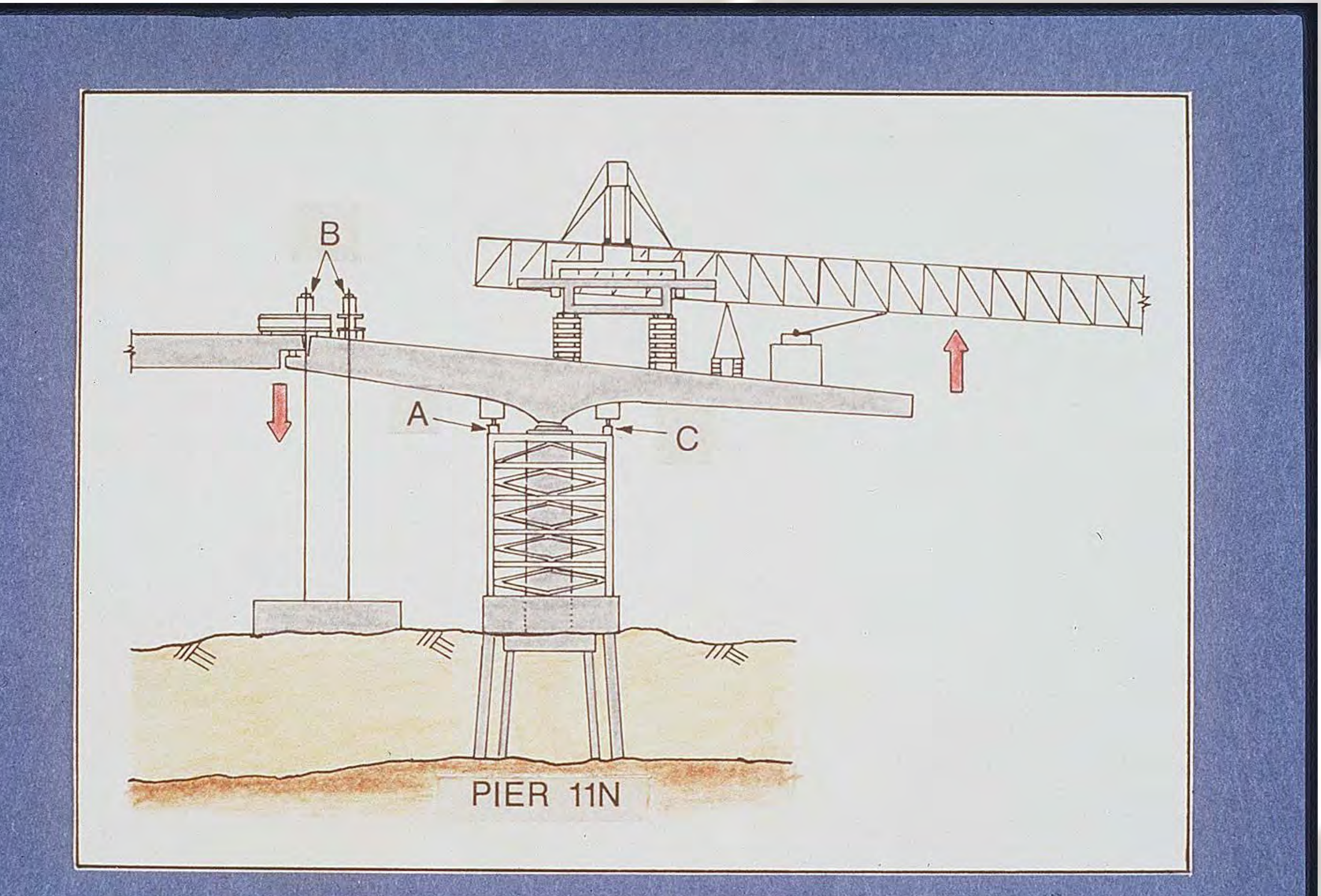
Repair contract: 1983 – 1984

- Uncertainty remained that Pier 11N was still moving
- Launching girder was not to move until footing was stabilized

Repair contract: 1983 – 1984

- Pier 11N columns were largely undamaged, footing was unsalvageable
- Pier 11N bearings over rotated and needed to be replaced
- Expansion hinges and span 12 segments could be salvaged
- A very complex repair scheme was prepared, that had to be completed in steps:
    - Stabilize Pier 11N, construct new footing
    - Building jacking structure to unload Pier 11N bearings
    - Construct large concrete counter weight below joint
    - Utilize jacking procedure to rebalance cantilever 11
    - Repair joint 12, remove and replace ungrouted tendons

Repair Contract 1983 – 1984



Repair Contract 1983 – 1984

Repair Contract 1983 – 1984

Repair Contract 1983 – 1984

Repair Contract 1983 – 1984

Repair Contract 1983 – 1984

Repair Contract 1983 – 1984

Repair Contract 1983 – 1984

Repair Contract 1983 – 1984

- Tie down pad and cables

Repair Contract 1983 – 1984

- Tie down pad and horizontal jacks

Repair Contract 1983 – 1984

- Tie down strong back at joint 12

Repair Contract 1983 – 1984

- Repair complete, ready for second contract

Second contract: 1985 – 1988

Second contract 1985 – 1988

- Prior to 1982 accident on NB, SB cantilevers 25S to 20S were complete, and the closure pour between 20S and 21S was made

- The delay from the first contract termination, and repairs caused cantilever 20S to deflect downward more than designed

- To correct vertical alignment, 9” was removed from the top of pier 19S in 1985

- Longitudinal post tensioning tendon paths, bulkhead tendon locations and anchorage locations in the as built structure vary significantly from the contract plans

Second contract 1985 – 1988

- Cantilever erection on NB continued through the winter of 1985/1986 to facilitate moving the launching girder up the completed NB structure so SB erection could begin in the spring of 1986. Several problems resulted:
    - Epoxy grout was not setting properly due to cold
    - Moisture pooled and froze in draped ungrouted longitudinal tendon ducts causing web wall spalling
    - Closure pours at the south end of NB are cracked
    - PT anchor blister on segment 7NND failed, and was retrofitted with steel plate
    - Transverse PT rib on segment 5NSB failed and was retrofitted with steel plate

Second contract 1985 – 1988

- Tendon trumpets and spirals were omitted in Expansion Joint Segment 4NSG. Epoxy was used to attach 1 ½” thick steel plates at the location of each omitted tendon trumpet. In addition, 28 post-tensioning bars were stitched through the deck and stressed in the area behind where the tendon trumpets were omitted

- While moving the launching girder, the rear leg of the gantry tracked off the web centerline and punched through the deck at Segment 11SSE. A new, larger, non-prestressed transverse rib was constructed

- Bottom slab tendons in Segments E and F near the expansion joints had kinks that caused the bottom slab to spall.   Tendons were removed and reinstalled in re-aligned ducts, or spalls were repaired with epoxy injection

Second contract 1985 – 1988

- Segment damage due to water in tendon ducts

Second contract 1985 – 1988

➢ Segment repairs at failed PT locations

Second contract 1985 – 1988

- Segments 20SNO and 20SNP bottom slabs were cast 6" too thick at one face, creating a downward thrust at the joint. This truss is vertically post tensioned into the joint to pull the slabs, counter acting the thrust

Second contract 1985 – 1988

Second contract 1985 – 1988

Second contract 1985 – 1988

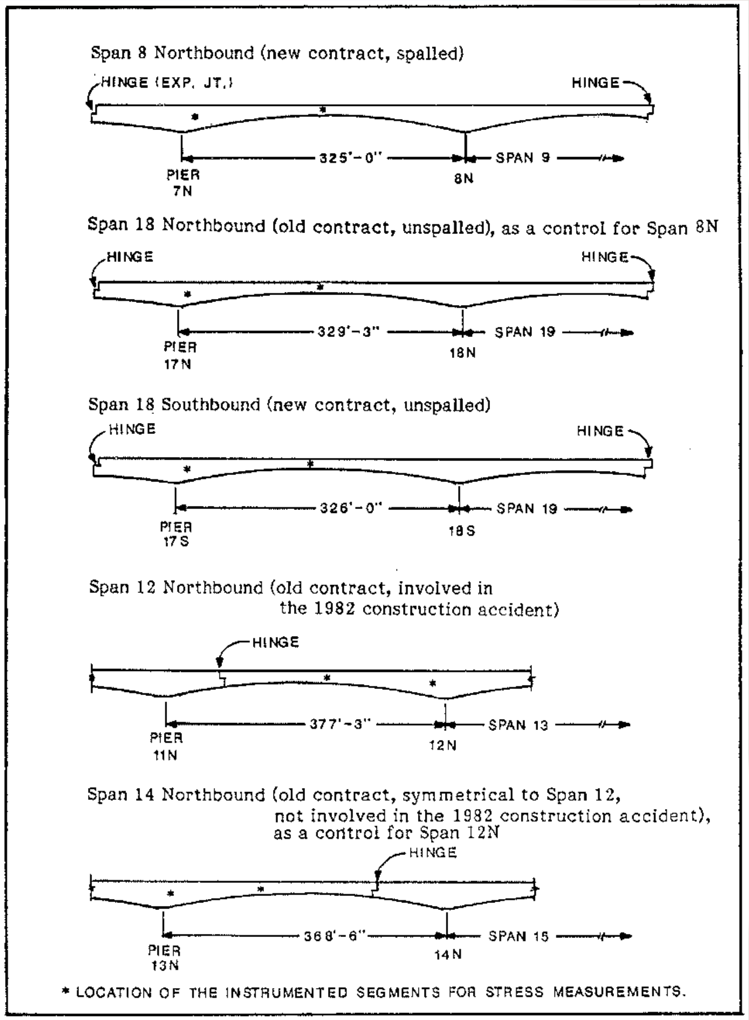
Second contract 1985 – 1988

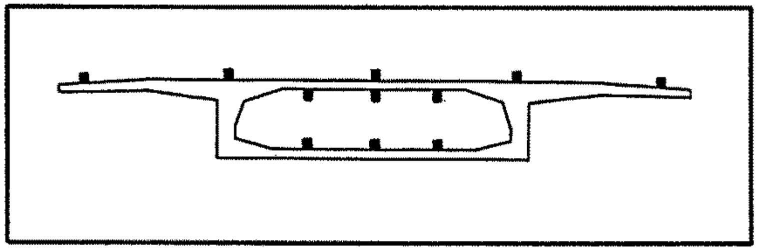

1987 Load test

1987 Load test

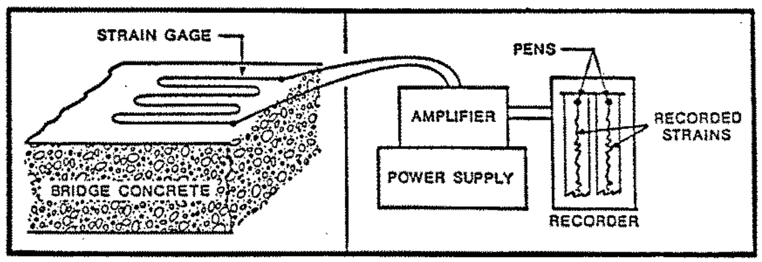
- Upon completion of the repairs, questions arose as to the effectiveness of the repairs, and the overall load carrying capacity of the bridge
- MDOT decided to perform load tests on several spans using the heavily loaded segment hauler
- Spans selected were typical spans from both contracts NB and SB, span 12N, and span 8N
- Actual deflections and stresses were compared to a computerized structural analysis of deflections and stresses

1987 Load test

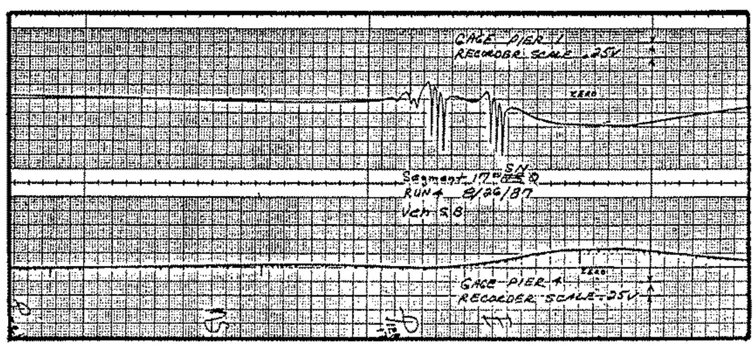




Location of strain gages.

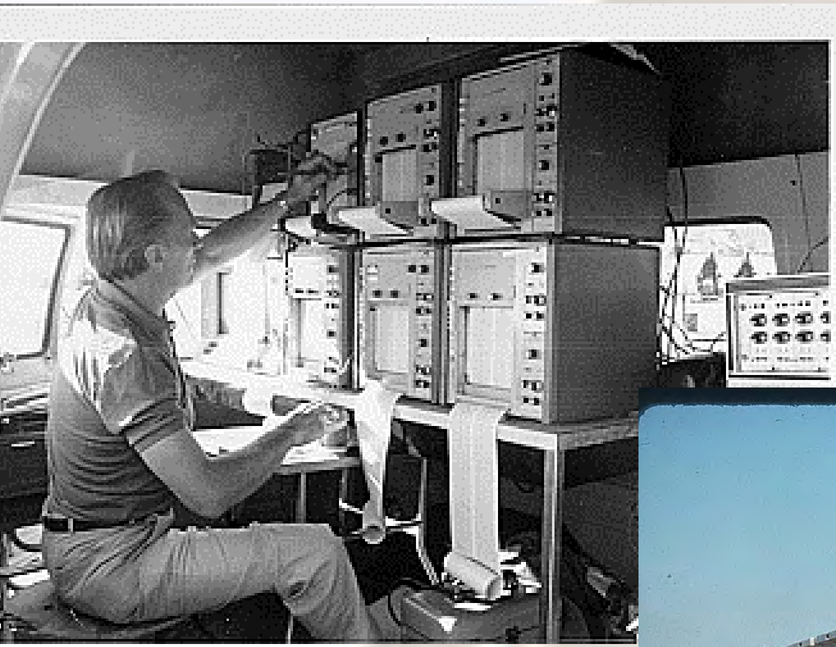


Strain gage and electronic circuit set-up.

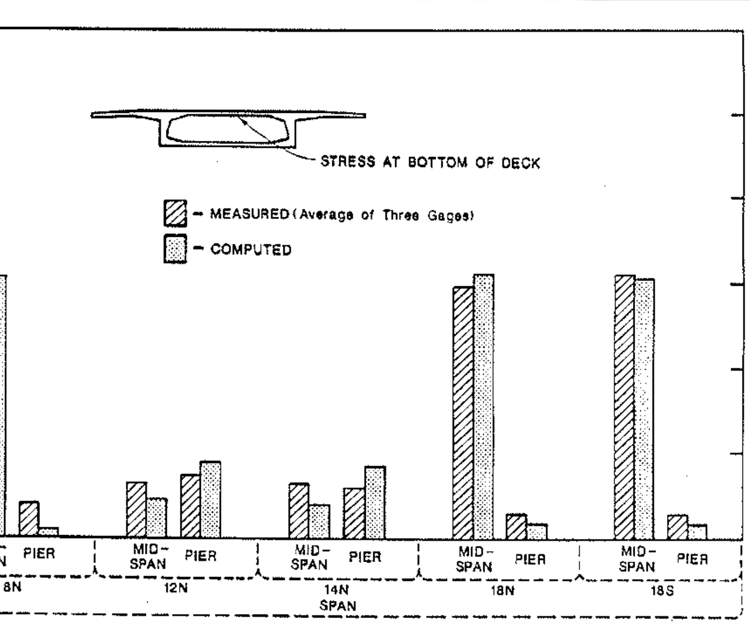


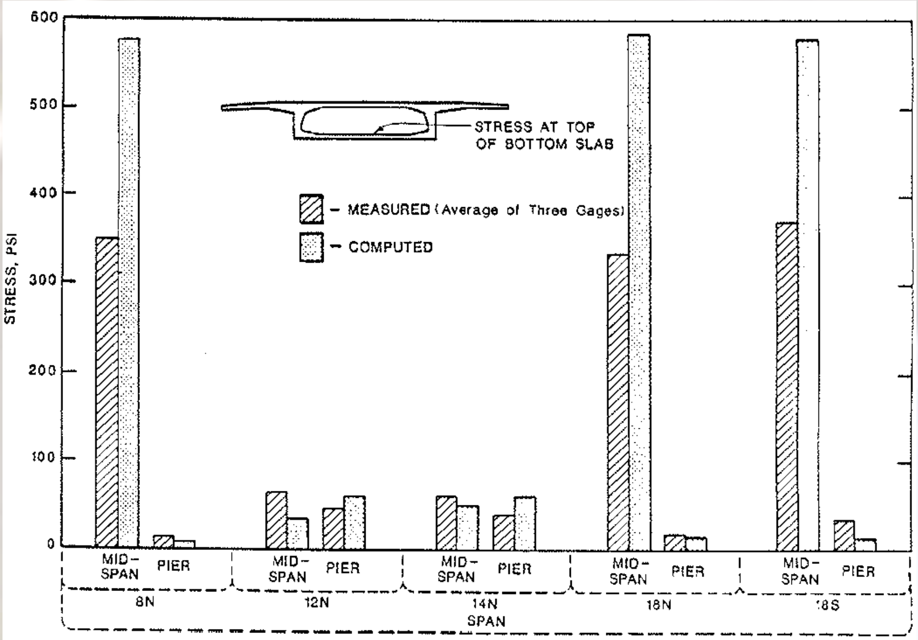
Strain gage recorder output.

1987 Load test

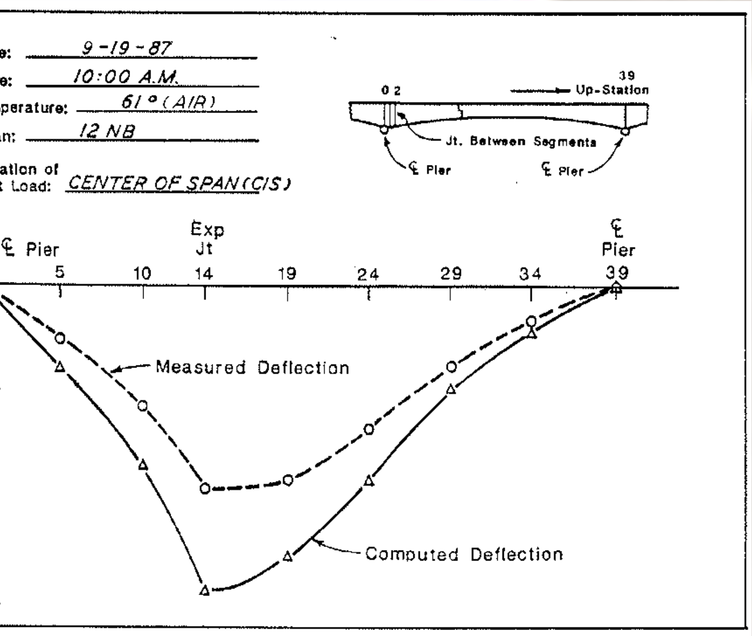


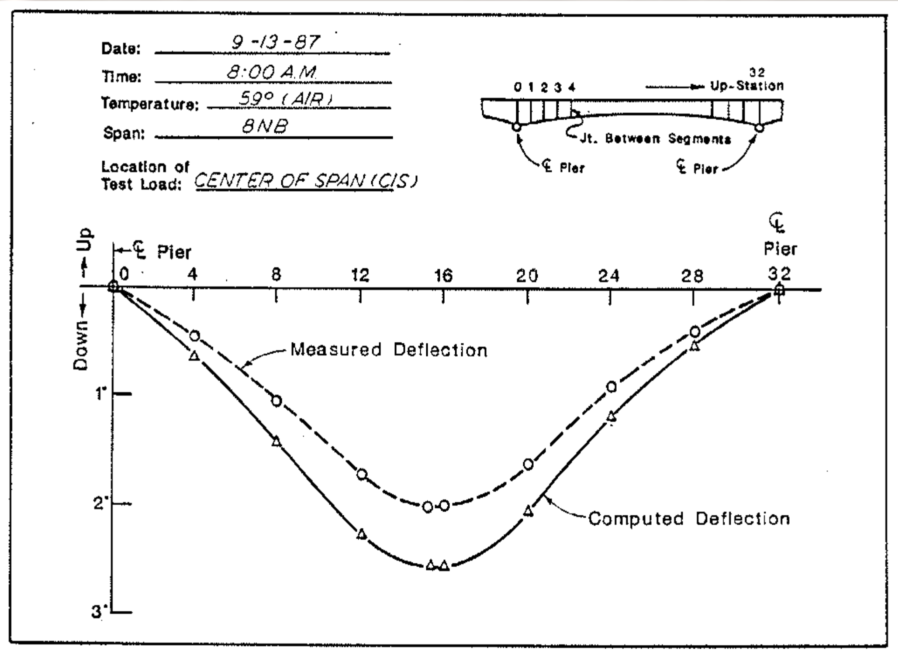
1987 Load test





1987 Load test





1987 Load test

- Conclusions:
  - Actual deflections and stresses were less due to excellent quality of concrete, f'c = 7800 psi at the time of test, computed values used design f'c = 6000 psi
  - Latex overlay and barrier contribute the bending stiffness
  - Performance of the structure is superior or at least equal to designed values

24 years of operation

24 years of operation

- Maintenance facilities established in the early 1990's
- Pier 17N strut was externally post tensioned in 1995
- Expansion joints were replaced in 2001
- Engineering inspections have been conducted every 4 years since 1989, next engineering inspection scheduled for 2013 after current bearing replacement project is complete
    - Bearing replacements were recommended as early as 1993
    - Bearings extruding elastomer as early as 1989

24 years of operation

24 years of operation

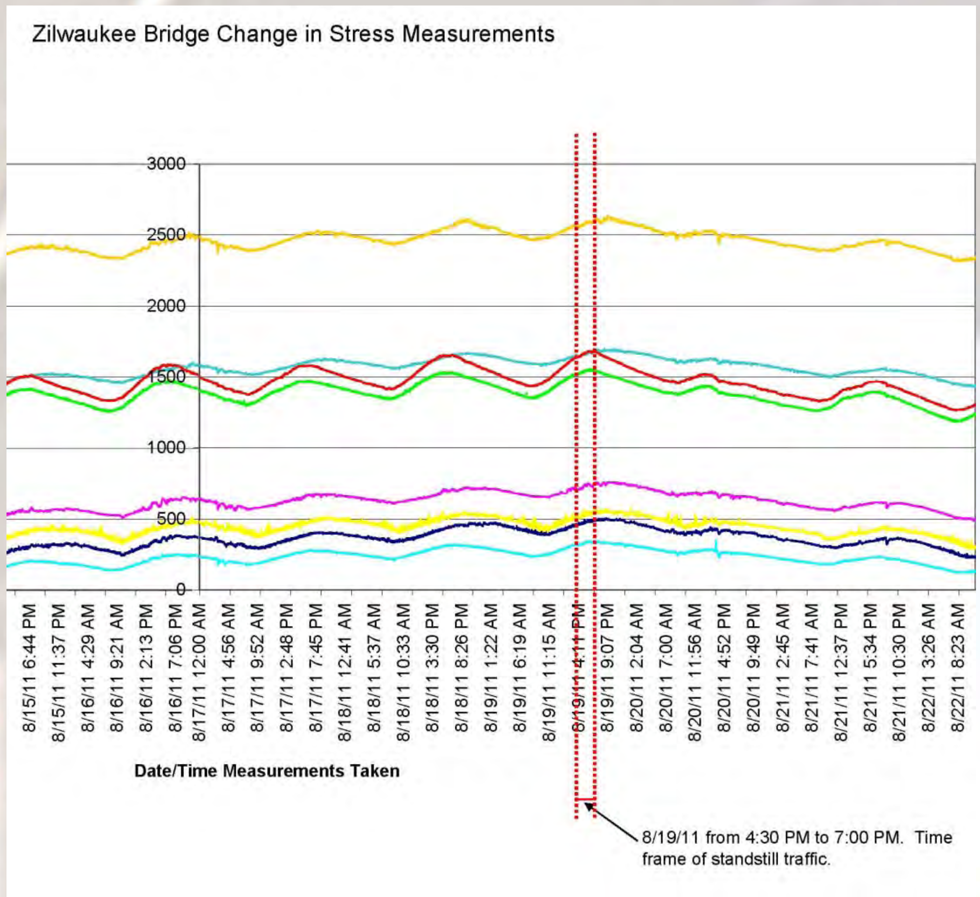
24 years of operation

gust 19, 2011, accident
rth of the bridge closed NB
5, traffic backed up 4 miles

lanes loaded on NB
ucture over entire length

uck hauling prestressed
am stopped over repaired
pansion joint 9N where
ain gages were installed
er 2008 retrofit

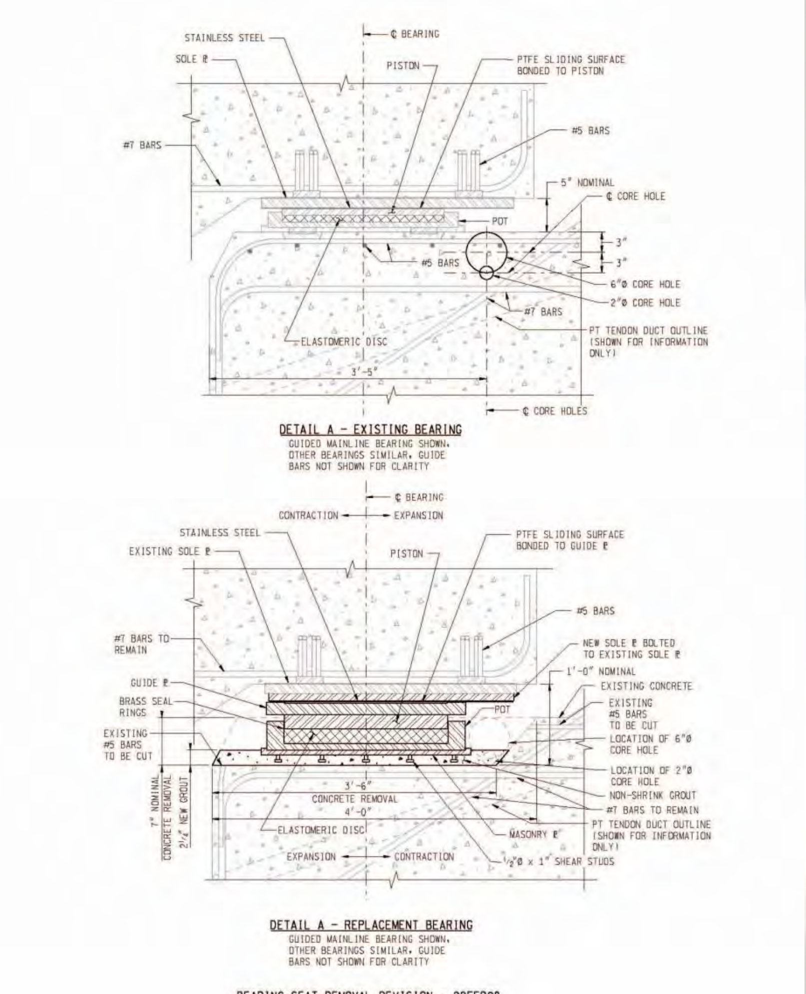
discernible increase in
esses



2007 Bearing replacement project

Zilwaukee Bridge Bearing Replacement

- earing Replacement at Expansion Joints
  - Preventive Maintenance Work
  - 34 Bearings at 17 locations
  - New Bearings were designed to current standards, and therefore thicker
- ontractor – Midwest Bridge
  - Original Contract Amount - $3,000,000



Zilwaukee Bridge Bearing Replacement

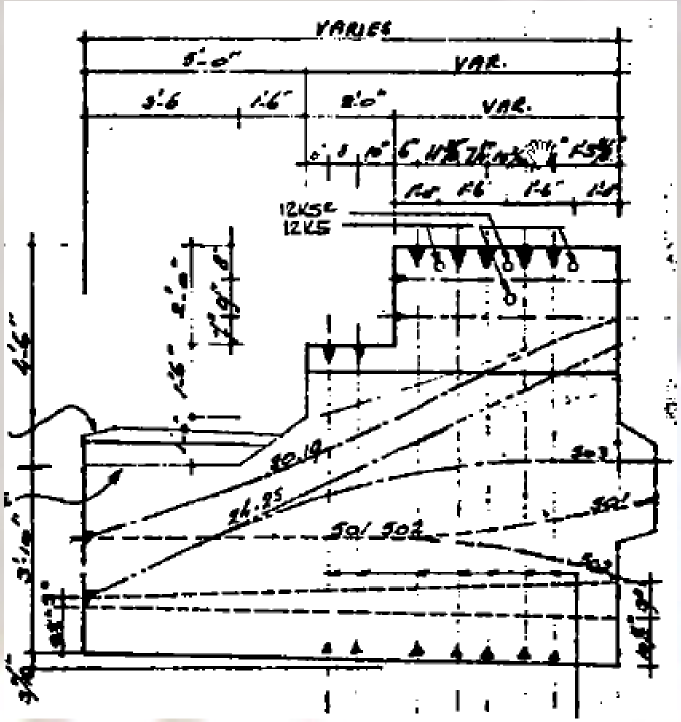
- follow current AASHTO service criteria, the new bearing systems were thicker than the existing systems so that they would last longer. The original design of the bridge made provisions for deeper bearings, although thinner bearings were installed in the original construction

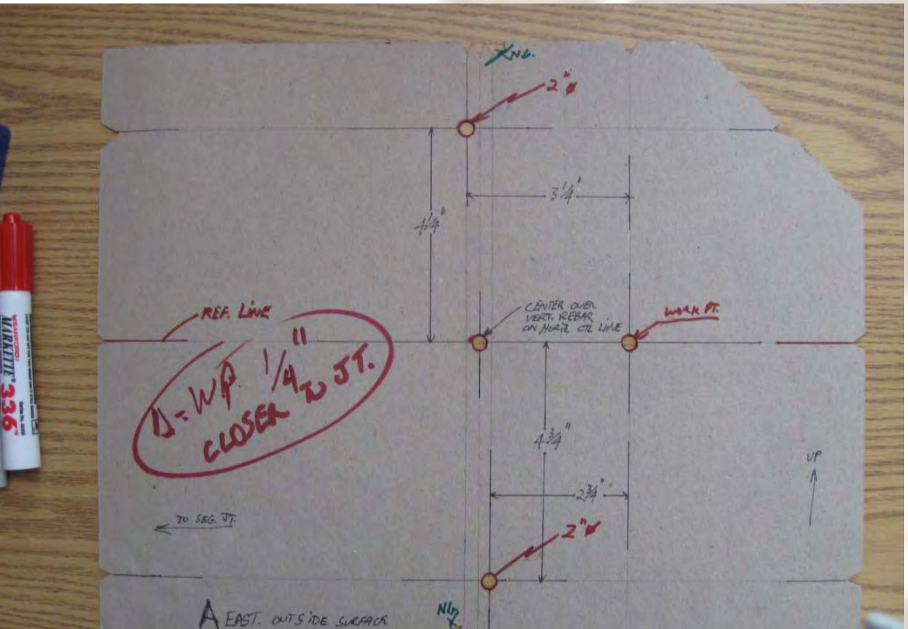
- e initial plan was to remove 5” – 7” of concrete from the supporting (lower) cantilever segment to accommodate the thicker sole plate and bearing pots

- ore drilling was to be performed to create hole from which a concrete saw could be used to cut the seat of the bearing, which was integral to the cantilever segment

Zilwaukee Bridge Bearing Replacement

sing the existing shop drawings,
e steel rebar and tendons were
refully laid out, and drilling
oints determined



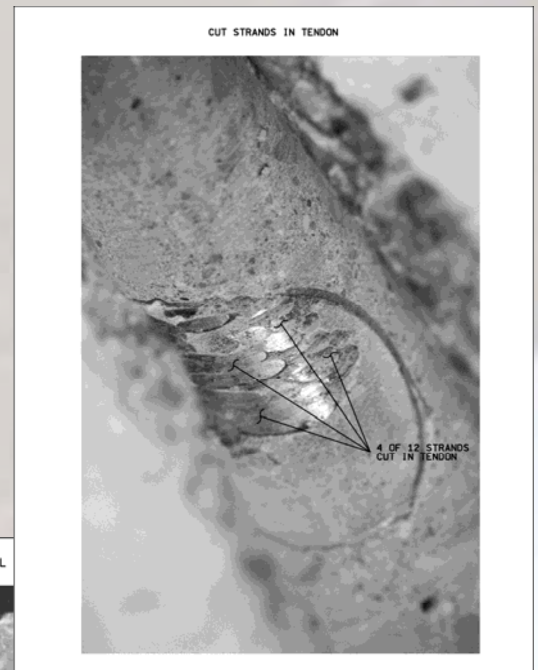


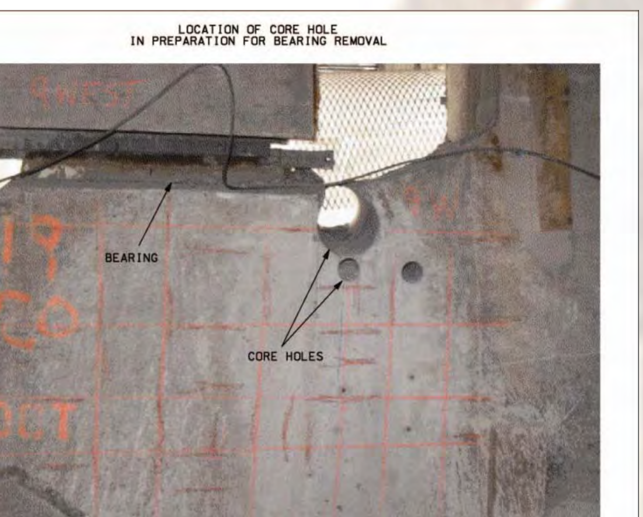
Zilwaukee Bridge Bearing Replacement

rilling commenced in May 2008 for the
rong back placement and the bearing
eat removals

Zilwaukee Bridge Bearing Replacement

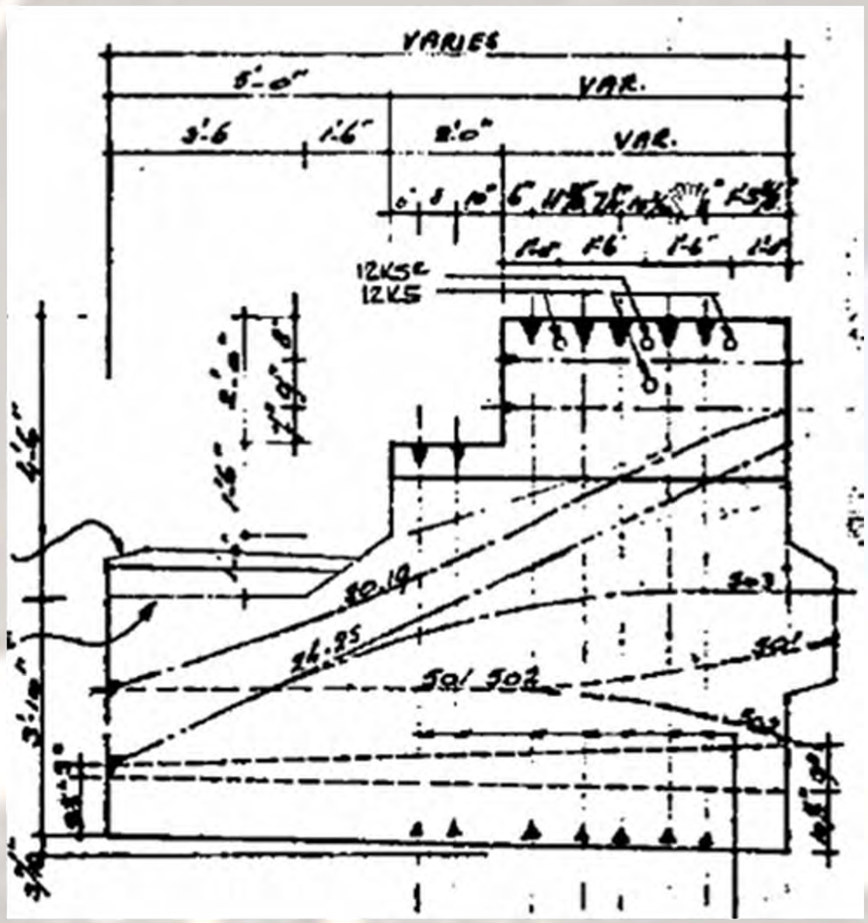
hen coring commenced, primary
ntilever reinforcement bars, and steel
ndons used to post tension the
dividual segments together were
expectedly cut





Zilwaukee Bridge Bearing Replacement

- xisting shop drawings not clear
  - Original Design had an option for thicker bearings
  - Reinforcing Steel & Post-Tensioned strands not shown in this area
  - Shop drawings are not as builts, and do not accurately reflect changes made during fabrication



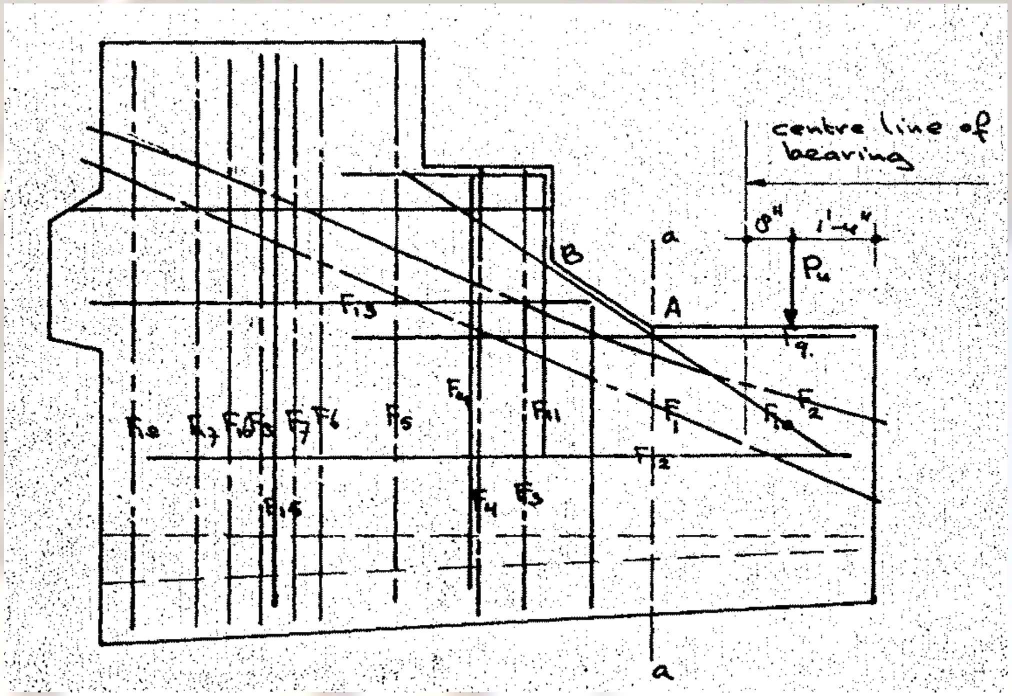
Zilwaukee Bridge Bearing Replacement

he extent of the damage was as follows:
- 1 out of 12 strands in one tendon were cut, and 5 – 7 out of 12 strands in a second tendon were cut
- #7 cantilever bars were cut

he project was immediately suspended
- The project turned from bearing replacement to emergency repairs
- Parsons (designer) developed external post tensioning retrofit
- Janssen & Spaans Engineering reviewed retrofit design, and provided technical expertise during fabrication & installation

Zilwaukee Bridge Bearing Replacement

riginal design noted high stress concentrations at points A and B. Vertical prestressing bars, mild steel bars and draped post tensioning tendons all resisted shear and moment



= 2142 kips

Zilwaukee Bridge Bearing Replacement

hat forces were lost:

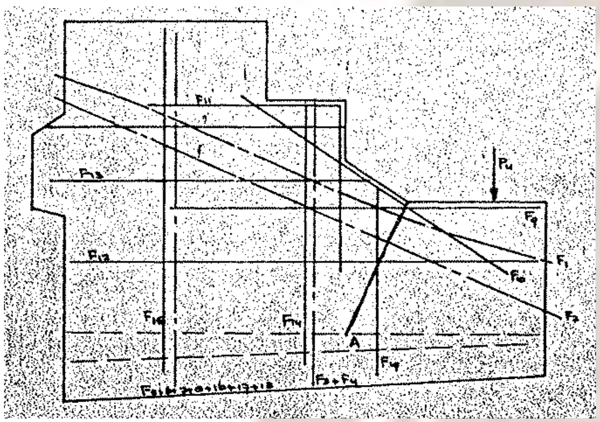
1 cut strand = 1/12 * 0.95 * 496k = 40k
7 cut strands = 7/12 * 0.95 * 496k = 275k
cut #7 bar = 0.60 in^2 * 60 ksi * 3 bars = 108k

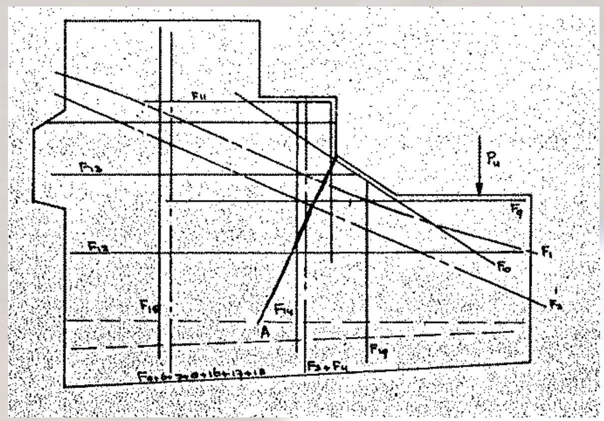
rough total of 423k of resistance was lost

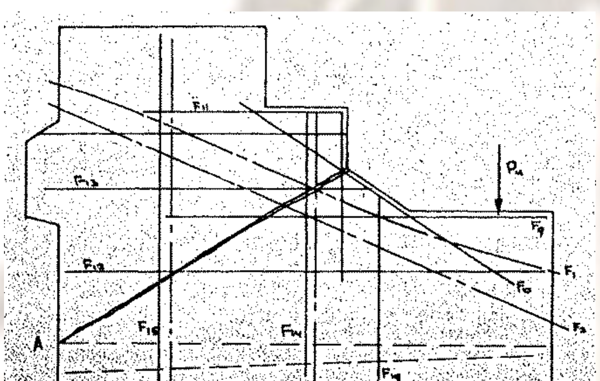
kternal post tensioning retrofit required to compensate for ese loses

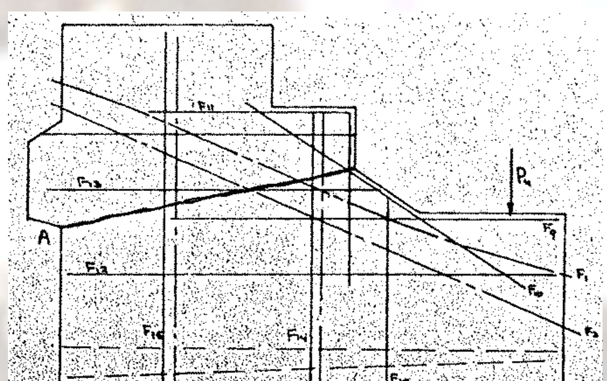
Zilwaukee Bridge Bearing Replacement

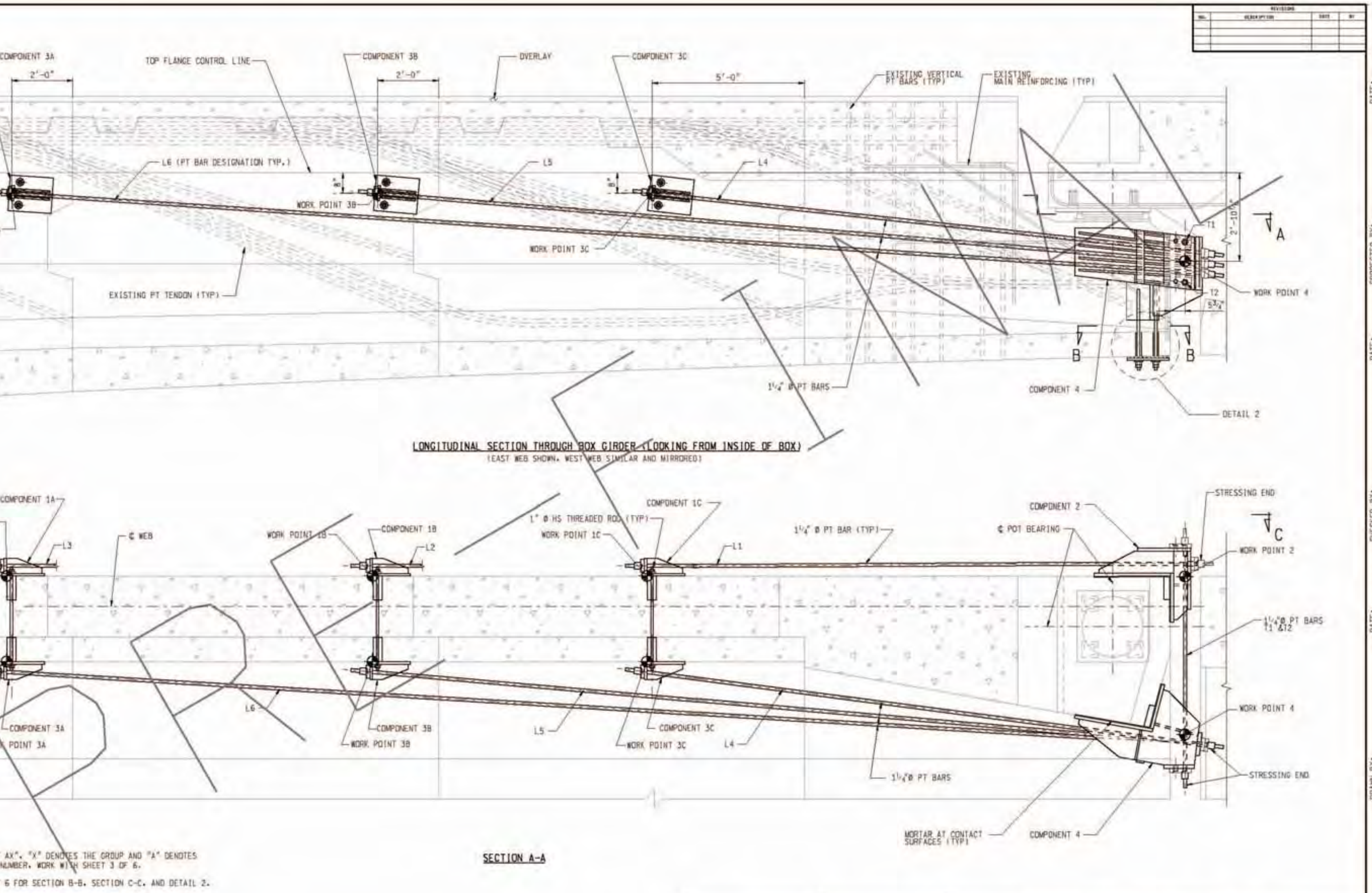
hese bars cross several critical cracking planes:











AX". "X" DENOTES THE GROUP AND "A" DENOTES
NUMBER. WORK WITH SHEET 3 OF 6.

6 FOR SECTION B-B, SECTION C-C, AND DETAIL 2.

D REINFORCING SHOWN FOR ILLUSTRATION ONLY.
T ASSEMBLY NOT SHOWN. OVERLAY IS SCHEMATIC.

ENTED HEREIN SHOW THE REPAIR FOR THE EAST WEB. THE WEST
SIMILAR BUT MIRRORED RELATIVE TO THAT OF THE EAST WEB.

PARSONS | MDOT Michigan Department of Transportation

RETROFIT ASSEMBLY – ALTERNATE A
I-75 OVER SAGINAW RIVER AT ZILWAUKEE

DATE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET
5/6/2008	B03 OF 73112	88349A	GROTENHUIS	1 OF 6

Zilwaukee Bridge Bearing Replacement

ne retrofit compensates for the loss of post tensioning tendons damaged by core drilling, and helps support the cantilever bearing segment

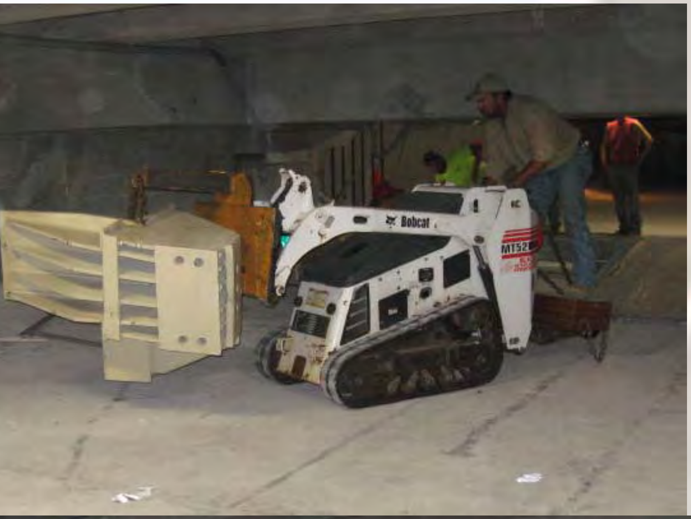
volves large bearing assemblies and post tensioning rods to distribute loads over several segments

DOT staff worked closely with the contractor, designer, and technical experts to ensure proper installation despite complexity of configuration, and the need to core additional holes in the web walls of the bridge segments

Zilwaukee Bridge Bearing Replacement

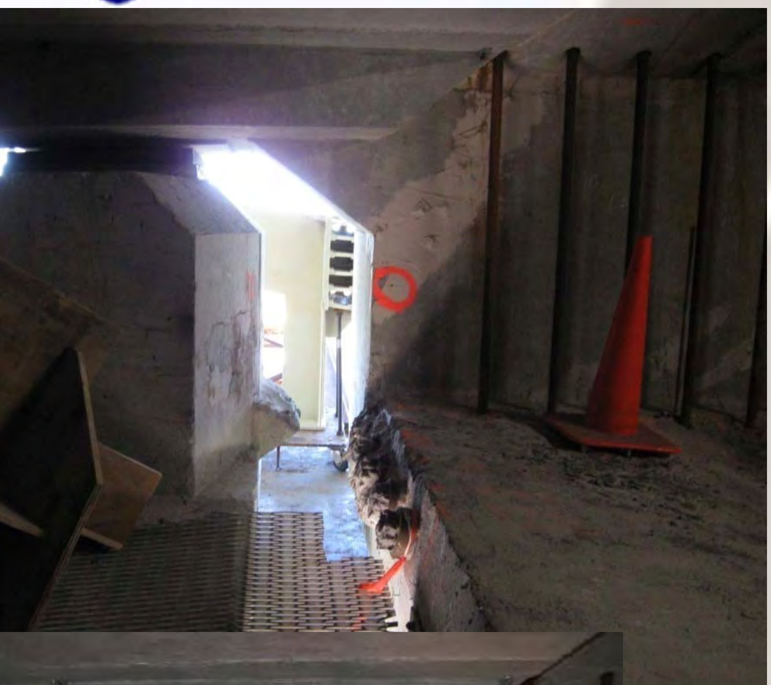
Zilwaukee Bridge Bearing Replacement

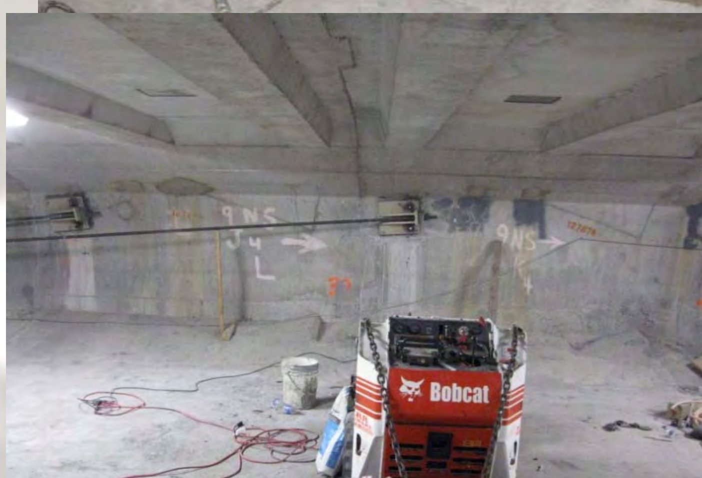
Zilwaukee Bridge Bearing Replacement




Zilwaukee Bridge Bearing Replacement

Zilwaukee Bridge Bearing Replacement





Zilwaukee Bridge Bearing Replacement

st tensioning operation using
hydraulic jacks, and computer

Zilwaukee Bridge Bearing Replacement

rain gages were installed to
onitor strain in cantilever
gment at high stress areas, and
ta is sent to BFS

Zilwaukee Bridge Bearing Replacement

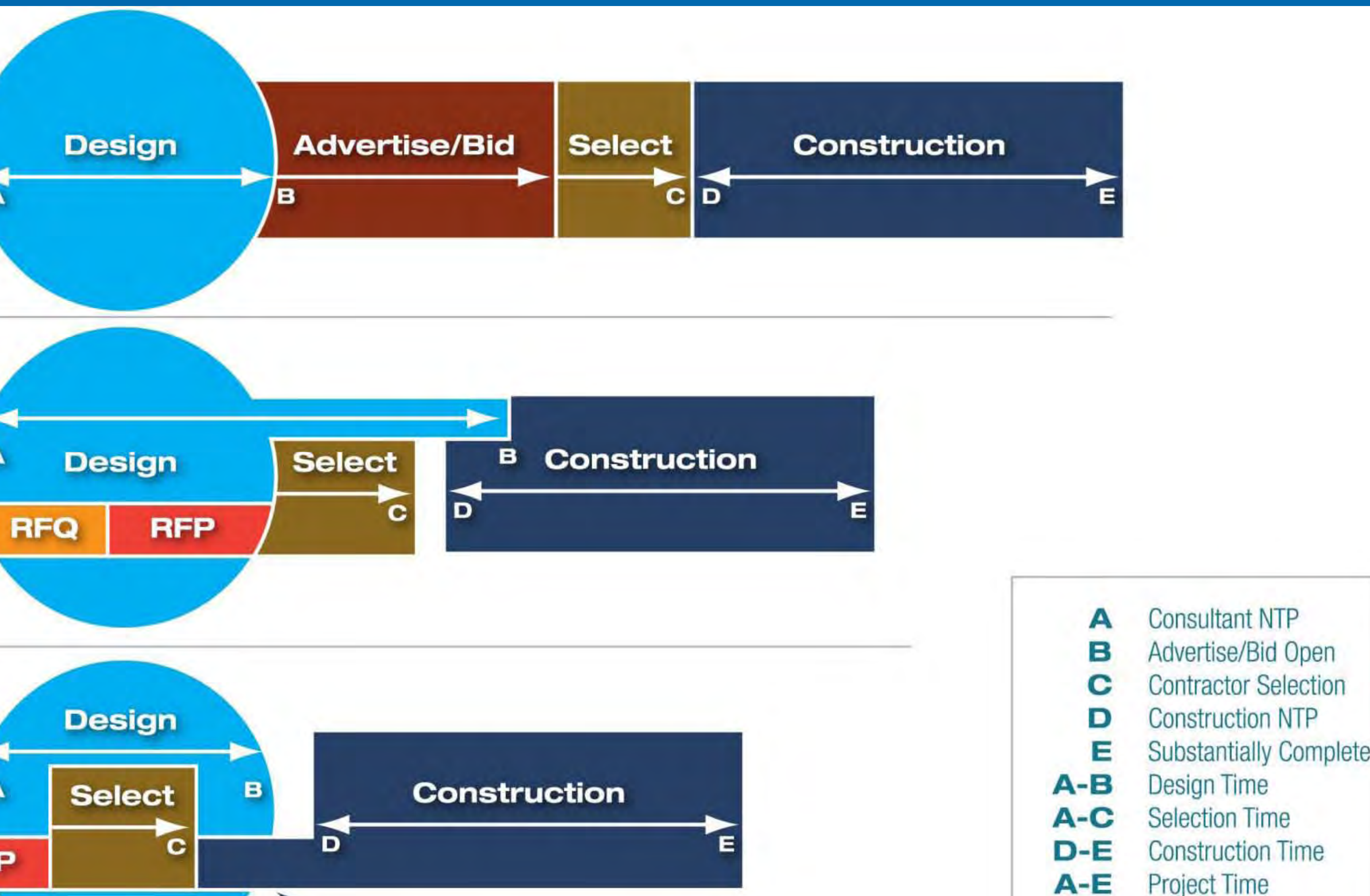
- on completion of
stallation, all elements
re coated

Zilwaukee Bridge Bearing Replacement

Original Contract Amount		**$3,285,355.59**
Contract Items Delivered & Paid For		**$2,085,183.37**
Bearing Assemblies (all 34)		
Temporary Support Systems		
Balance of Contract Not Completed		**$1,200,172.22**
Estimated Extra Costs to Repair Damage		
Retrofit Assembly – Fabrication	$375,557.80	
Retrofit Assembly – Installation	$404,928.82	
Permanent Cross-Over Construction	$310,051.49	
Additional Traffic Control, Cross-Over Operation	$89,740.88	
Standby Equipment	$65,915.81	
Miscellaneous Extras	$122,824.80	
Subtotal		**$1,369,019.60**
Estimated Other Contract Adjustments		
Decreases in Original Contract Items	-$536,228.03	
Increases in Original Contract Items	$14,737.00	
Subtotal		**-$521,491.03**
Estimated Remaining Contract Balance		**$352,643.65**

Current status of CM/GC bearing replacement project

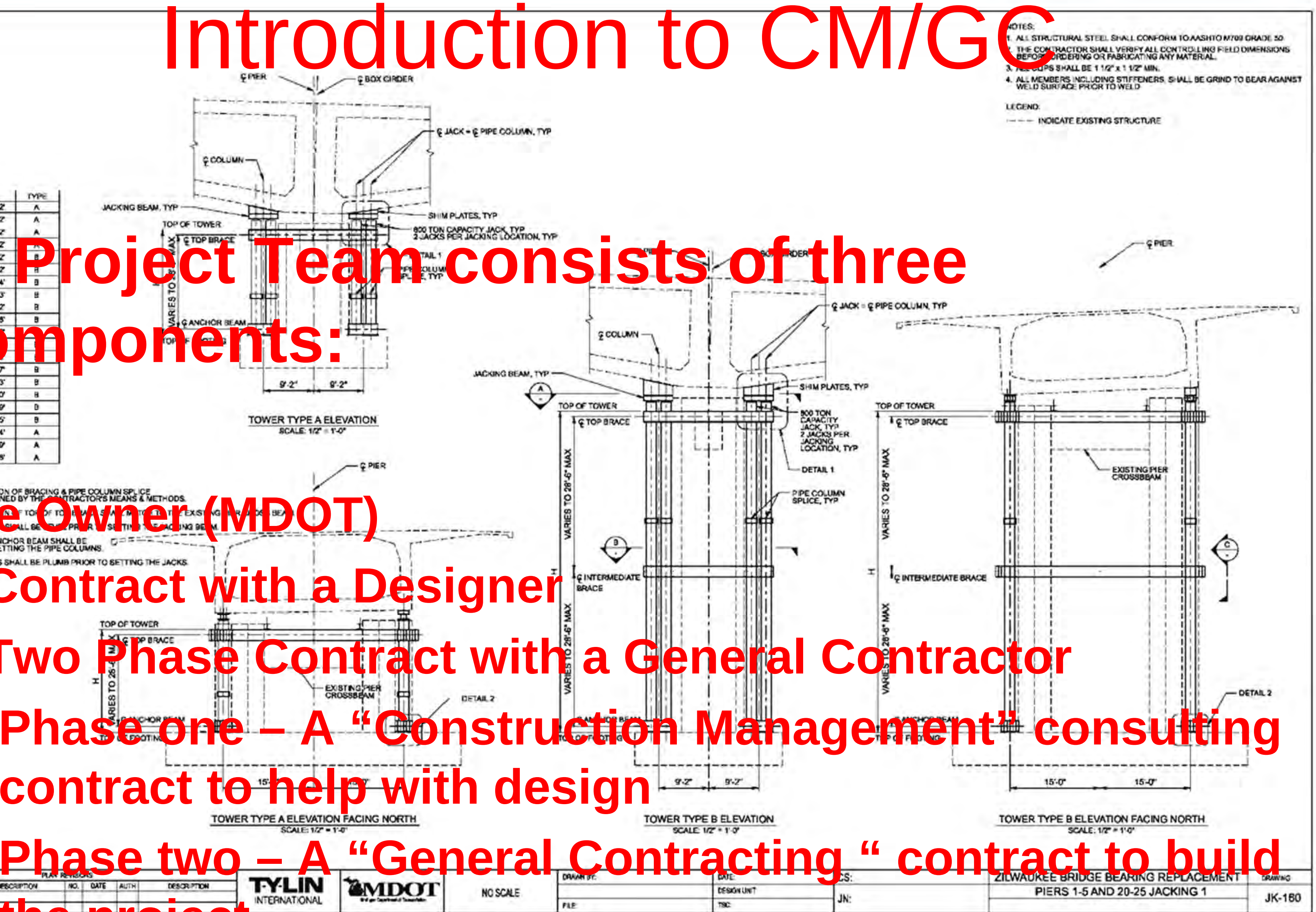
Introduction to CM/GC



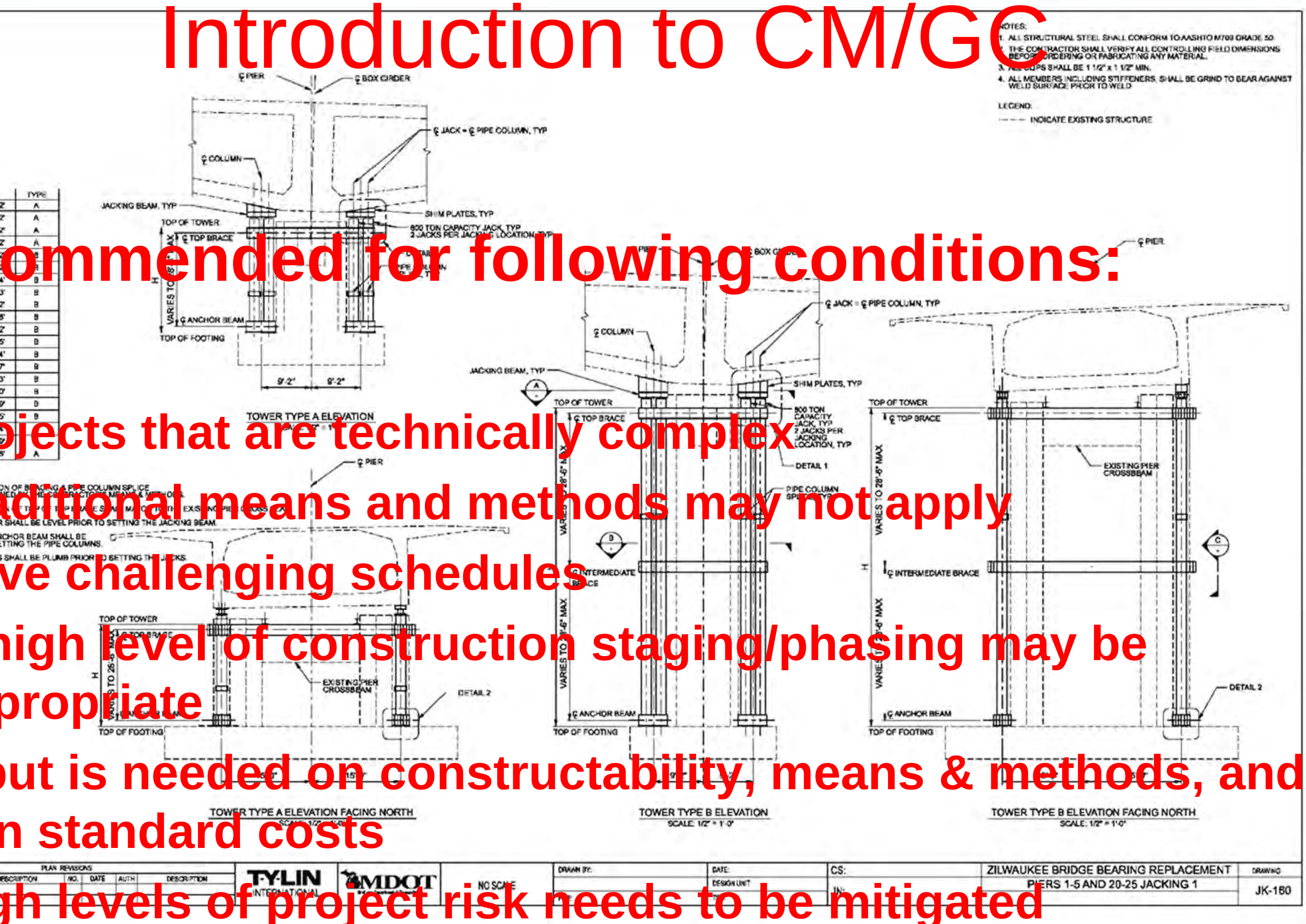
Introduction to CM/GC

Project Team consists of three mponents:

- **e Owner (MDOT)**
  - **Contract with a Designer**
  - **Two Phase Contract with a General Contractor**
    - **Phase one – A “Construction Management” consulting contract to help with design**
    - **Phase two – A “General Contracting “ contract to build the project**



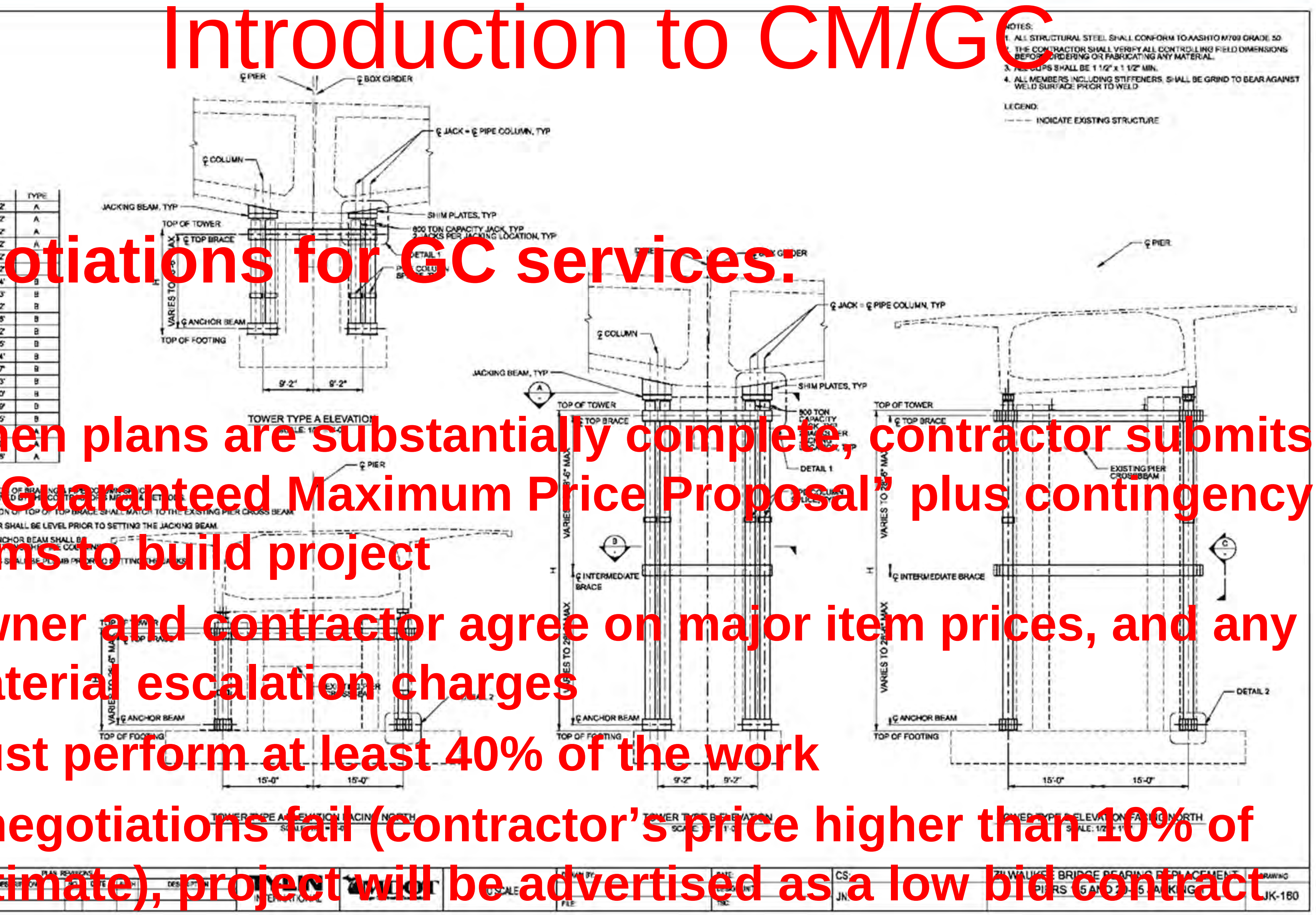
Introduction to CM/GC



ommended for following conditions:

- ojects that are technically complex
- aditional means and methods may not apply
- ve challenging schedules
- high level of construction staging/phasing may be propriate
- put is needed on constructability, means & methods, and n standard costs
- gh levels of project risk needs to be mitigated

Introduction to CM/GC



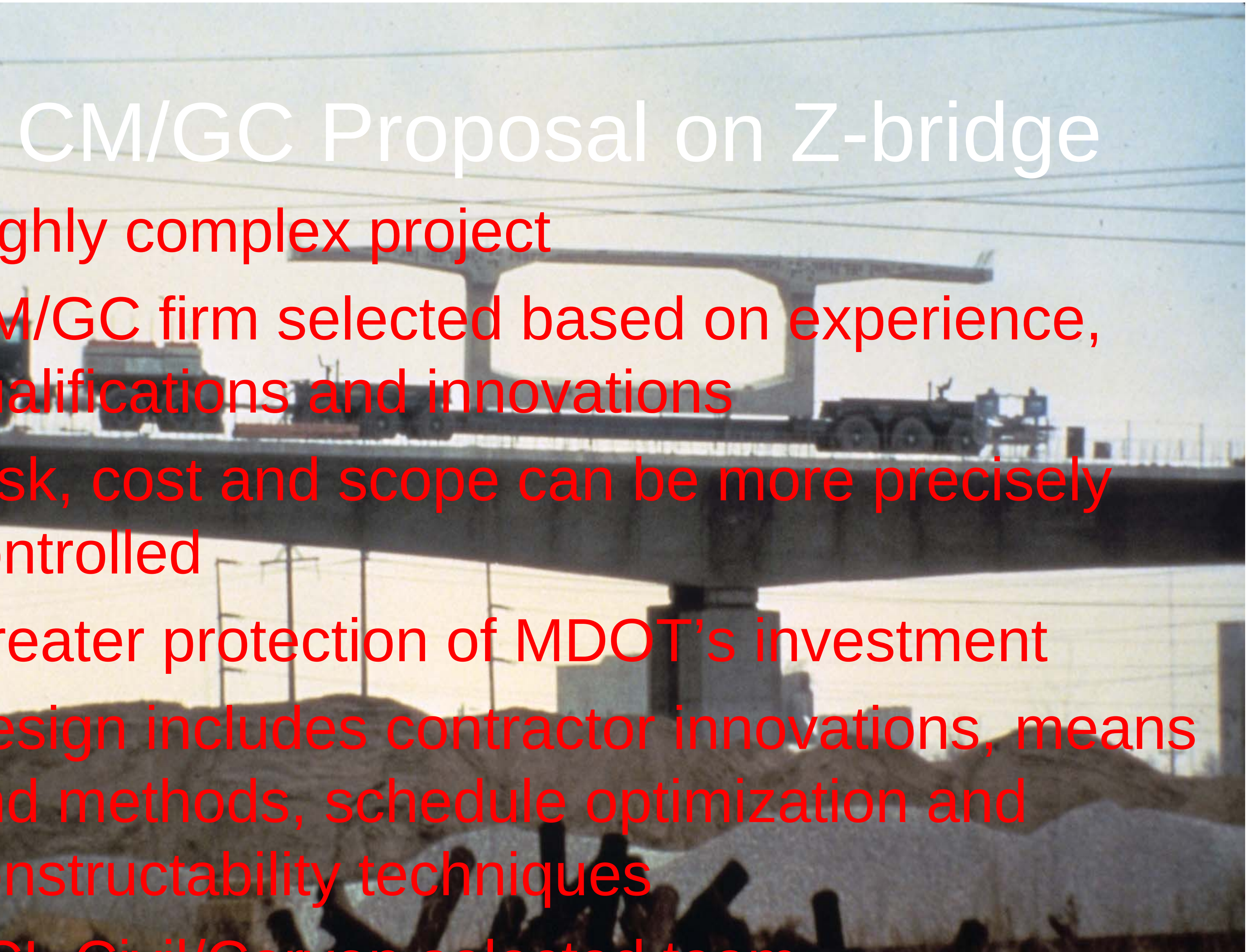
otiations for GC services:

hen plans are substantially complete, contractor submits Guaranteed Maximum Price Proposal” plus contingency ms to build project

wner and contractor agree on major item prices, and any aterial escalation charges

ust perform at least 40% of the work

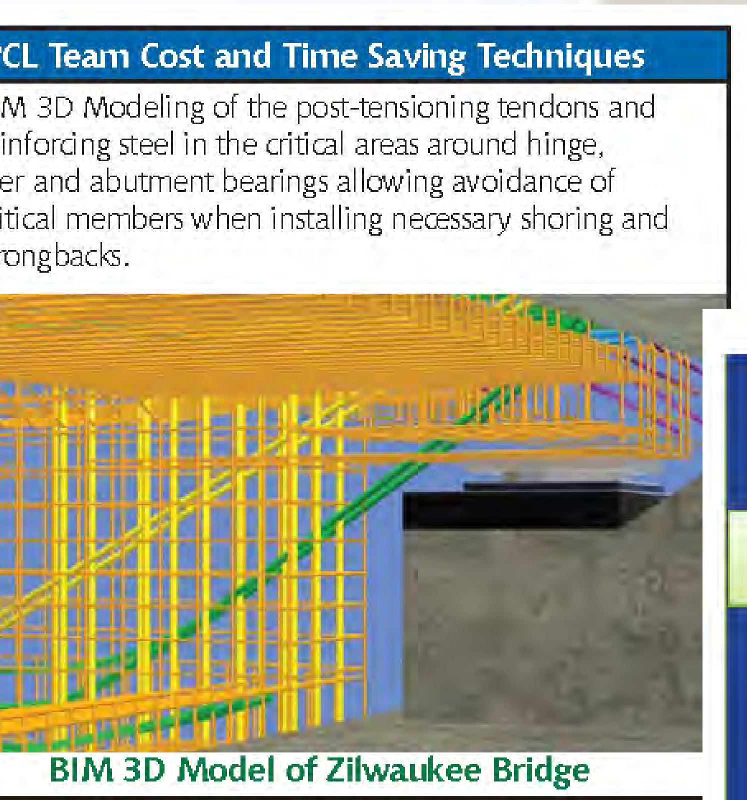
negotiations fail (contractor’s price higher than 10% of timate), project will be advertised as a low bid contract

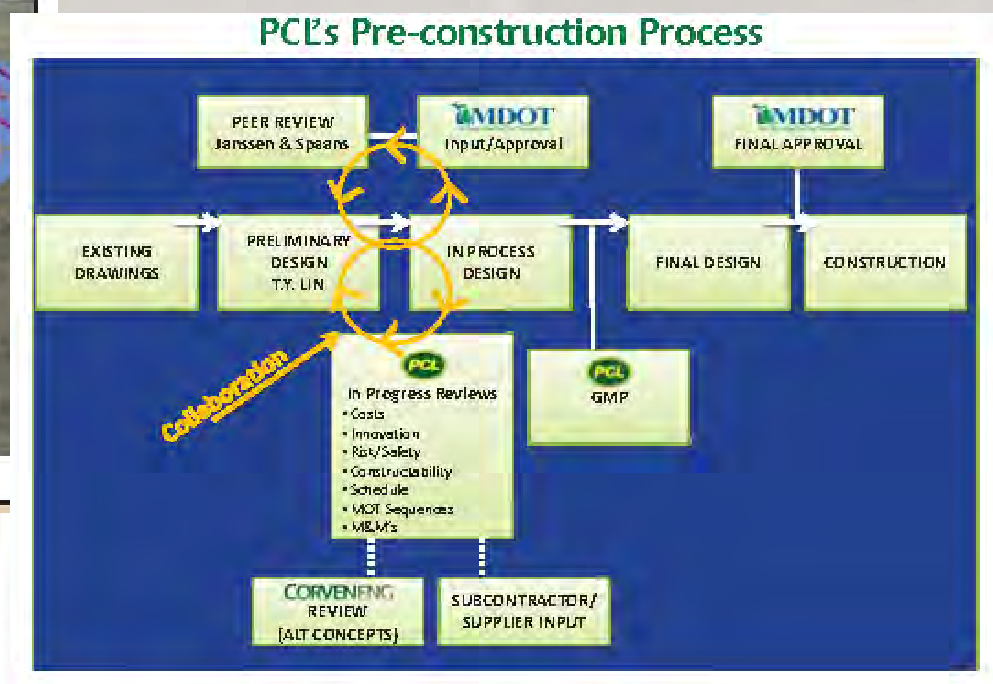


CM/GC Proposal on Z-bridge

- ghly complex project
- M/GC firm selected based on experience, ualifications and innovations
- sk, cost and scope can be more precisely ntrolled
- reater protection of MDOT's investment
- esign includes contractor innovations, means d methods, schedule optimization and nstructability techniques

CM/GC Proposal on Z-bridge





Excellent innovations and procedures proposed

CM/GC Proposal on Z-bridge

- Plans currently at 30% complete
- CM/GC, owner and design team to meet in mid April
- Construction to begin in winter 2012 with mobilization and erection of shoring towers
- No I-75 lane closures until 2013
- $30 million in roadway reconstruction each end of the bridge
- Project to be managed by Bay City TSC and Bridge Field Services

ank you for
ur time

Zilwaukee Bridge

Questions?