W 8 C 3

Memorandum Date: October 24, 2006
Order Date: November 8, 2006

TO: Board of County Commissioners

DEPARTMENT: Public Works

PRESENTED BY: Sonny Chickering, County Engineer

AGENDA ITEM TITLE: IN THE MATTER OF CONFIRMING A TEMPORARY CLOSURE OF THE COYOTE CREEK COVERED BRIDGE (STATE BRIDGE ID 39C409) LOCATED AT M.P. 0.1 ON BATTLE CREEK ROAD.

I. MOTION

THAT THE ORDER BE APPROVED CONFIRMING A TEMPORARY CLOSURE OF THE COYOTE CREEK COVERED BRIDGE (STATE BRIDGE ID 39C409) LOCATED AT M.P. 0.1 ON BATTLE CREEK ROAD.

II. AGENDA ITEM SUMMARY

Recent ODOT bridge inspections have revealed structural instability of the covered bridge warranting an immediate closure until repairs can be made. Our own bridge consultant has analyzed the bridge and concurred with this recommendation.

III. BACKGROUND/IMPLICATIONS OF ACTION

A. Board Action and Other History

A construction contract in the amount of $293,350 was awarded (Board Order 06-6-21-11) on June 21, 2006 for the structural repair of the Coyote Creek Covered Bridge. The project was listed in the 2006-2010 Capital Improvement Plan (CIP) under the Structures Category in the amount of $200,000. Repairs are anticipated to be completed by summer of 2007. The action by the Board will be temporary, until these permanent repairs can be made.

B. Policy Issues

Per Lane Code 15.215, the Director of the Department of Public Works is delegated authority by the Board to impose temporary weight restrictions on roads and bridges pursuant to ORS 810.030, under emergency conditions, and may post bridges or roads with such weight restrictions in the event of threat to public safety

or extensive damage to public roads or bridges.

C. Board Goals

This action meets Goal 5 of the adopted Lane County Transportation System Plan (TSP): To promote safe, functional, and well-maintained road and bridge network in Lane County. In addition, it meets Policy 5-f of the TSP: Maintain and restore Lane County covered bridges for their historic, aesthetic and cultural value as feasible, through budget allocations to the Capital Improvement Program or other funding sources.

D. Financial and/or Resource Considerations

Permanent construction repairs are to be done by contract, per Board Order 06-6-21-11. Immediate protection measures for the bridge will be done by County Public Works Maintenance Staff, through their normal Operations and Maintenance Budget. County may seek reimbursement of these costs from the Contractor for the permanent repair project.

E. Analysis

Background

Board Order Number 93-7-14-15 imposed a weight limitation of 10 tons for all vehicle types on the Battle Creek Road/Coyote Creek Covered Bridge. Structural repairs to the Coyote Creek Covered Bridge were initially going to be performed by the County Public Works Bridge Crew. However, it was determined that the repairs were more involved than what the Bridge crew could perform, so the bridge project became part of the adopted FY 06-10 CIP program.

The bridge rehabilitation and repair generally consists of replacing most of the timber truss components, reconstructing end bent number 4 (including steel piling installation), x-bracing and correction of truss racking. Continued deterioration in the wood components of the bridge justifies the bridge rehabilitation. The improvements were designed to ensure the historic covered bridge status, including meeting the State Historic Preservation Office (SHPO) requirements for rehabilitation of an historic structure.

The construction contract had a notice to proceed dated July 18th. The original schedule provided by the contractor indicated that work would be completed by the fall of 2006. However, the contractor did not complete their in-water work by the last day of the required in-water work period, which was September 30th. The beginning of the next in-water work period will be July 1 of 2007.

Existing Bridge Condition

The biannual inspection of the Coyote Creek Covered Bridge was made Tuesday, October 3rd by OBEC Consulting Engineers under contract to the Oregon Department of Transportation (ODOT). The inspection was conducted as part of an ongoing program of bridge inspections that is required in order to comply with National Bridge Inspection Standards (NBIS). The inspection reported that while the structure itself is still carrying limited loads with no problem, the rotation of the entire Covered Bridge towards the upstream side had increased since the last inspection and repair work three years ago. They recommended immediate closure of the bridge, which was implemented by Lane County staff on October 4th.

ODOT followed up with an October 13th letter and reiterated that the bridge be closed to all traffic, including pedestrians, until the tilt and sway bracing (racking) issues are resolved through the rehabilitation project during 2007. They were concerned that wind loading could also place substantial and potentially damaging horizontal loads on the structure, in addition to potential snow loads this winter.

Since it is ultimately the County's responsibility as the owner of the bridge to either post or close a bridge, we further collaborated with our own on-call bridge consultant, CH2M Hill, Inc. They provided an engineering assessment of October 18th (attached to this memo) of the reported increase in leaning, or racking, of the covered bridge. They also reviewed the lateral loads and portal framing capacity of the covered bridge, and based on this, made recommendations to us.

Recommendations

On page 3 of the Technical Memorandum by CH2M Hill, lateral capacity is discussed as follows:

> *Due to the unknown, uncertain or inadequate lateral capacity of each of the contributing systems to the overall lateral resistance and stability of the structure, the safety of the bridge in use is also not verifiable and the bridge should remain closed until the bridge is repaired or a temporary strengthening of the bridge should be constructed before re-opening the bridge to traffic.*

The consultant recommended one means of temporarily strengthening the bridge end portals until permanent repairs are made would be to add timber framing and sheath the inside faces of the portals with plywood, thereby creating a shear wall system around the traffic openings, at each bridge end. These repairs are to help resist lateral loads, such as wind, or the horizontal component of applied snow loads, and are not meant to provide a permanent structural solution. Full bridge

repairs can be completed in the summer of 2007 under the existing bridge repair contract.

The detour mapping for the closure of the bridge is shown on sheet number 3 of the contract construction drawings, attached to this memo. For residents traveling north on Territorial Highway, the bridge closure will require about 1.25 miles of out of direction travel. One concern by some area residents and County staff is high water on Wolf Creek Road and Coyote Creek Road if Coyote Creek runs high this winter. This may happen about three times per year, or never, depending on the amount of winter rain. We recommend that if the water is too high to travel safely on the detour roads, then the bridge be opened up to a posted weight limit of 3 Tons during the high water period, and immediately reclosed. This assumes that the temporary strengthening of the bridge end portals as discussed above provides adequate shear strength against lateral forces. Assessment of this situation will be provided by County staff.

F. Alternatives/Options

To summarize, the various alternatives or options available to the Board are as follows:

1. Confirm closure of the bridge to vehicular and pedestrian traffic. Provide temporary protective end portal strengthening as recommended, monitor the bridge and nearby road system during this winter's flood events, and temporarily re-open the bridge on an emergency basis to a weight limit of 3 Tons during said road flooding.

2. Confirm closure of the bridge to vehicular and pedestrian traffic, provide temporary protective end portal strengthening, but do not open to any traffic until permanent repairs are made.

IV. TIMING/IMPLEMENTATION

If the bridge closure is approved by the Board, staff will send out an informational letter to affected property owners, Emergency Service Providers, School districts, and other interested members of the community. The State Historic Preservation Office will also be contacted alerting them to the temporary sheathing repairs. The bridge posting will be reduced to 3 Tons in case of emergency re-opening during flooding; and the Oregon Department of Transportation will be notified of the actions being taken by the County.

V. RECOMMENDATION

Staff recommends Option 1.

VI. FOLLOW-UP

Staff will follow-up as outlined above and as directed by the Board.

VII. ATTACHMENTS

Attachment A: October 18, 2006 Technical Memorandum by CH2M Hill
Attachment B: Sheet No. 3 of the Construction Plans showing Detour Routing
Board Order

Coyote Covered Bridge Inspection and Evaluation

EXPIRATION DATE: 31 DEC 2007

PREPARED FOR: Lane County, Oregon

PREPARED BY: Kelly B. Freeman

DATE: October 18, 2006

INTRODUCTION

This technical memorandum is an addendum to the "Coyote Covered Bridge Inspection and Evaluation" report of January 12, 2005, prepared for Lane County, Oregon. The need for an addendum is precipitated by the receipt of information not previously considered in the report, specifically, that the present degree of racking of the bridge trusses in the upstream direction is a condition that was not persistent for many years prior to the time of the report inspection, but instead was a condition more recently effected by the 2003 replacement of the vertical rods, and perhaps exacerbated by the replacement of the previous roof with a heavier material. This report summarizes the apparent history of the racking condition documented in the inspection reports, describes the lateral capacity of the current portal framing relative to gravity and lateral loads, presents a feasible temporary strengthening, and provides recommendations for action until the structure can be repaired during the summer of 2007.

INSPECTION DOCUMENTATION

The inspections of the bridge provided by Lane County for review are for the years 1995, 1997, 1999, 2001, 2003 and 2006. An inspection was also made about the time of the roof and vertical rod replacement in September of 2003, about a month after the 2003 bi-annual bridge inspection. The notes and recommendations from these inspections are summarized in the following table:

YEAR	INSPECTION NOTES PERTAINING TO RACKING	INSPECTION RECOMMENDATION	COMMENT
1995	Entire truss leans upstream from portal bracing removal	Replace portal bracing and realign truss	Bi-annual inspection
1997	None	Replace portal bracing and realign truss	Bi-annual inspection
1999	None	None	Bi-annual inspection

ATTACHMENT A

2001	Chords bowed upstream 2" & truss leans upstream 2-3"	Adjust tie rods and plumb trusses	Bi-annual inspection
2003	Trusses are slightly bowed and both lean upstream 2 3/4"	Analyze stability of trusses. Repair as necessary.	Bi-annual inspection
2003	*See excerpt below (*)*	*See excerpt below (*)*	Letter to County Sept. 3, 2003
2006	Trusses are slightly bowed and both lean U/S. D/S truss leans 3 3/4" and upstream truss leans 4"... Structure is leaning 3/8" to 1/2" per ft. of height. 10/06 called Lane County and closed bridge. Bridge settlement at Bent 4, Lt. most likely caused rotation.	*Recorded as "Inspector Work Candidates":* Rehab Elem | Timber Truss/Arch | ... | Urgent	Bi-annual inspection

(*) "We hung a plumb bob from the center of each top chord and found that, at the center of span, the top chords are displaced approximately 4" upstream relative to the bottom chords. This is more than can be accounted for by the slight tilt in the Bent 4 cap (*approximately 7/8"*) and suggests that the structure has racked. It is not believed that the amount of truss rotation observed is enough to induce structural instability; though, of course, it should be corrected."

During the November 22, 2004 inspection, conducted as part of the January 12, 2005 report by CH2MHILL, the upstream racking of the trusses were measured at about 5 1/4" for the downstream truss and 4 3/4" for the upstream truss. These measurements were repeated three times over the next two years, the last measurement being made October 6, 2006, and showed no appreciable change in the racking.

The similar amount of racking measured for the September 3, 2003 letter to the County and the 2006 bi-annual inspection performed by OBEC may indicate the racking has not increased since the replacement of the rods and roof in 2003, the measurement being about 4" in both cases, however, the method of measurement and location taken during the inspection is not documented and they may not be comparable. The measurements taken from November 2004 to October 2006 by CH2MHILL using a consistent location and means of measurement indicate a somewhat greater degree of racking, but reliably indicate that the racking has not increased for the past two years.

LATERAL LOADS AND PORTAL FRAMING CAPACITY

Once lateral loads are transferred to the end portals through the upper chord horizontal bracing system, the portal framing at the ends of the house are intended to be the primary and only mechanism for resisting lateral loads and maintaining the lateral stability of the structure. The replacement of the original knee braces with much smaller knee braces, probably quite some time before the 1995 inspection, has rendered the portal framing

comparatively weak and much more flexible than the original configuration. The smaller replacement knee braces are less effective than the original braces not only due to the revised configuration, but also from the use of spikes alone to make the connections to the header beam, without the benefit of inset daps as are used at the lower end of the braces. The use of spikes for this connection significantly increases the flexibility of the joint, and likely allows some lateral drift of the frame before the members of the frame are engaged to resist lateral movement.

In the present condition, the lateral stability of the structure is maintained and lateral forces are resisted by a combination of the portal framing, the siding at the ends of the house acting as a vertical shear wall, and the rotational restraint of the joints between the truss diagonals and the chords. The contribution of the board and batten siding to the lateral capacity of the structure is probably negligible and unreliable at best. The truss joint restraints are likely contributing significantly to the lateral capacity of the structure, but their strength and stiffness are not readily quantifiable due to the complexity of the joint behavior and the effects of deterioration on the joint strengths.

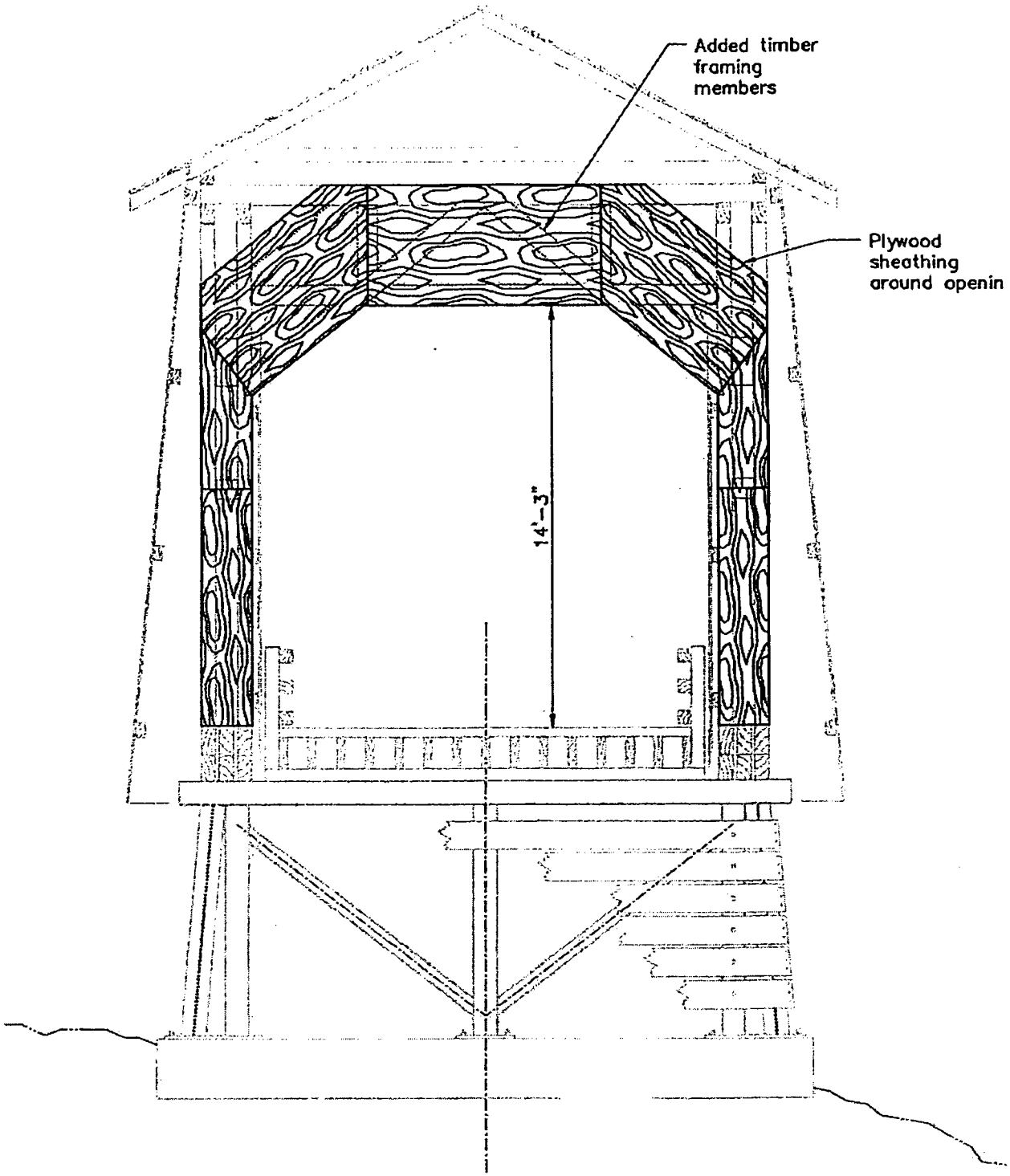
The calculated lateral strength of the portal framing alone is quite small due to the comparative weakness of the spiked connection between the knee braces and the header beam, and is dependent on the unknown size and penetration of the spikes. If two 50d to 60d spikes with 4 inches of penetration are assumed at the upper and lower ends of each knee brace, the lateral allowable capacity of the portal would be calculated at approximately 800 to 1000 pounds. This lateral capacity is roughly the magnitude of the lateral force effect caused by the racking from the combined gravity load effects of self weight, snow loads and an H10 live load, but is a fraction of the wind forces (calculated according to the 2003 IBC) at 4,400 pounds per portal. Under normal conditions, therefore, the portal framing alone does not have adequate capacity for lateral forces due to wind loads.

Due to the unknown, uncertain or inadequate lateral capacity of each of the contributing systems to the overall lateral resistance and stability of the structure, the safety of the bridge in use is also not verifiable and the bridge should remain closed until the bridge is repaired or a temporary strengthening of the bridge should be constructed before re-opening the bridge to traffic.

One means of temporarily strengthening the bridge end portals until permanent repairs can be made in the summer of 2007 is to sheath the inside faces of the portal with plywood to create a shear wall system around the traffic opening. This will require the addition of several framing members to the end portals to deepen the framed area below the header beam and knee braces, and will require some tie-down brackets at the lower ends of the posts. A concept sketch of the strengthening is attached.

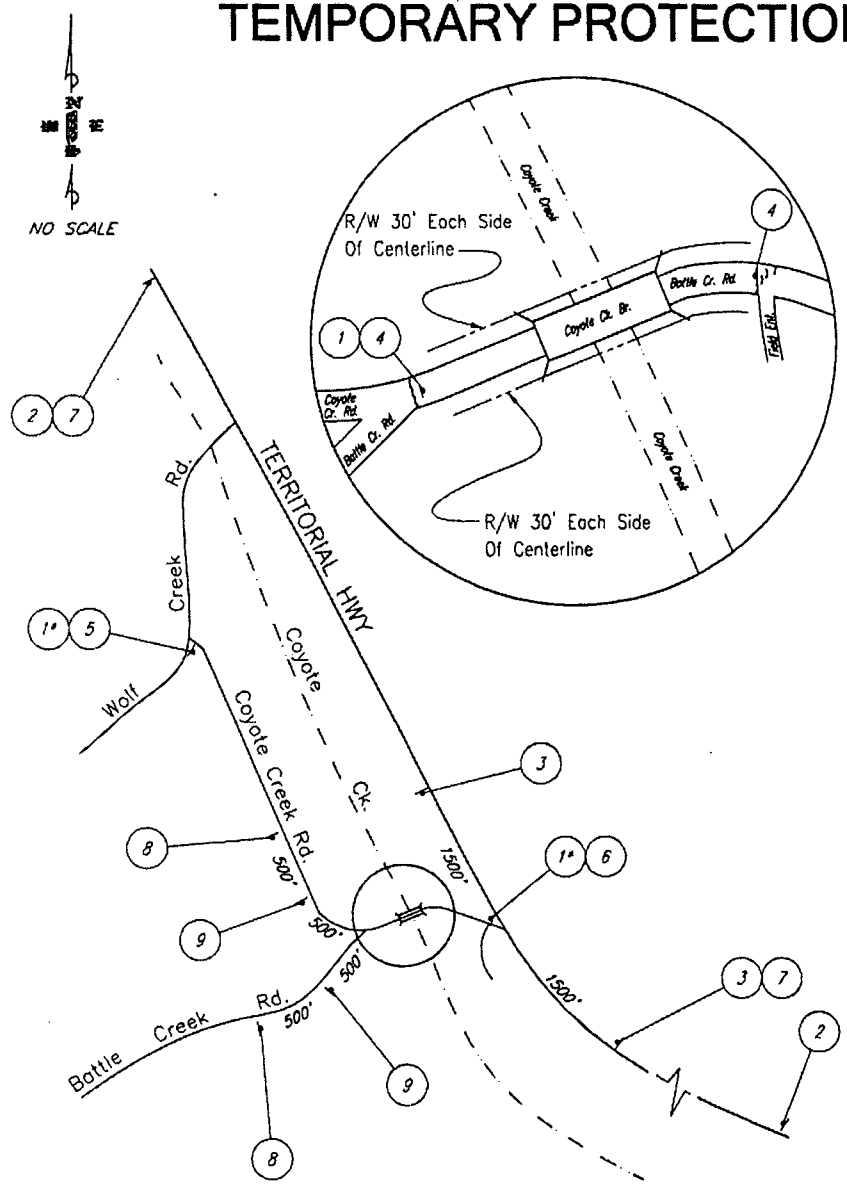
RECOMMENDATION

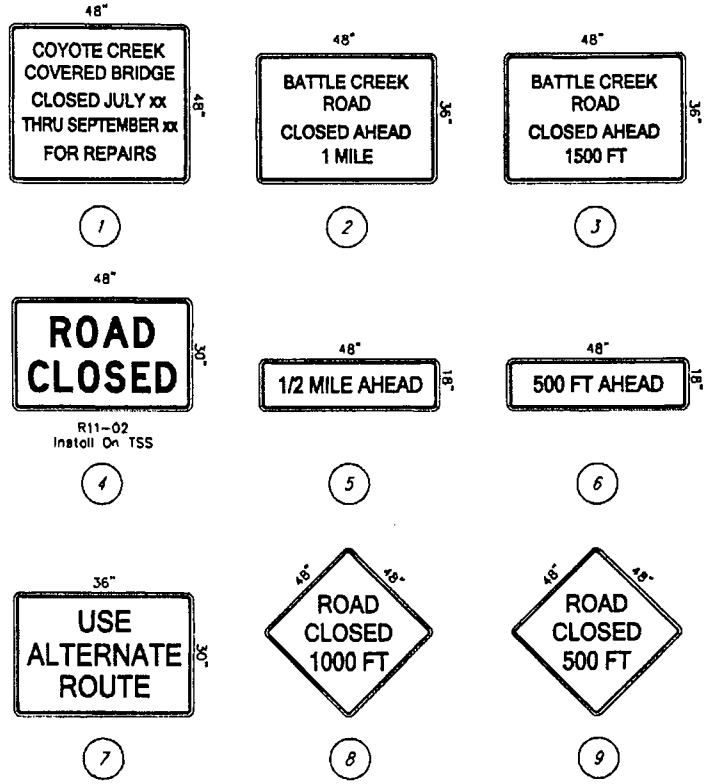
We recommend that the Coyote Covered Bridge remain closed until repairs are made or a strengthening of the end portals be installed before re-opening the bridge to traffic.



INSIDE VIEW OF END PORTAL
CONCEPT SKETCH OF TEMPORARY STRENGTHENING

TEMPORARY PROTECTION & DIRECTION OF TRAFFIC





NOTES:

1. *All Signs Shown On This Drawing Shall Be Post Mounted Or Mounted On Temp. Sign Supports. The Location And Mounting Height Shall Be In Accordance With Oregon Standard Drawing TM100 and The Manual On Uniform Traffic Control Devices.*

* *Place Sign Approx. 50 Feet From Intersection.*

Type III Barricade

2. *Provide Additional Signing As Shown On Oregon Standard Drawings RD900, RD905 RD908, RD910, RD935, RD950 & TM670, As Applicable Or As Directed By Engineer.*

3. *Contractor Responsible For Obtaining Any And All Permits Required By State Of Oregon For Sign Installation On Territorial Hwy.*

4. *All Permits Considered Incidental To Temporary Protection And Direction Of Traffic Bid Item.*

REGISTERED PROFESSIONAL ENGINEER
12,092
OREGON
JULY 15, 1983
EDWARD Q CHASTAIN
Expiration Date 12-31-07

LANE COUNTY
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
OLIVER P. SNOWDEN, Public Works Director
SONNY P. A. CHICKERING, County Engineer

Date	Revision	Appr'd

COYOTE CREEK
COVERED BRIDGE #18-5W-32
BATTLE CREEK ROAD - M.P. 0.117
Temporary Protection & Direction of Traffic

DATE	PROJECT NO.	ROAD #
June 2006	4062-2	4062-00

SHEET NO. 3

ATTACHMENT R

IN THE BOARD OF COMMISSIONERS OF LANE COUNTY
STATE OF OREGON

ORDER NO.

(IN THE MATTER OF CONFIRMING A TEMPORARY
(CLOSURE OF THE COYOTE CREEK COVERED BRIDGE
((STATE BRIDGE ID 39C409) LOCATED AT M.P. 0.1 ON
(BATTLE CREEK ROAD.

WHEREAS, The Coyote Covered Bridge at M.P. 0.1 on Battle Creek Road has been inspected on October 3, 2006 under an Oregon Department of Transportation (ODOT) contract with OBEC Consulting Engineers (OBEC) in compliance with National Bridge Inspection Standards (NBIS); and

WHEREAS, said inspection revealed rotation (racking) of the covered bridge trusses in the upstream direction, and said inspection report recommended immediate closure of the bridge: and

WHEREAS, on October 4, 2006 the bridge was closed to vehicular and pedestrian traffic by the County under the authority of the Public Works Director; and

WHEREAS, ODOT on October 13, 2006 recommended that the bridge remain closed until the racking issues are resolved during the 2007 construction year; and

WHEREAS, the County's own engineering consultant, CH2M Hill, has subsequently inspected said bridge and has recommended the bridge remain closed until either repairs are made during the 2007 construction year, or a temporary strengthening of the end portals is installed before re-opening the bridge to traffic; and

WHEREAS, per by Lane Code 15.215, the Director of the Department of Public Works is delegated authority to impose temporary weight restrictions on roads or bridges under emergency conditions in the event of threat to public safety or extensive damage to public roads or bridges, and to have such action confirmed by Board action at the next public meeting of the Board; and

WHEREAS, based on a staff analysis of the CH2M Hill report, the County Engineer has determined that the temporary strengthening of end portals shall be made to improve the lateral capacity and stability of the bridge to natural wind and snow forces; and

WHEREAS, the County Engineer has recommended that once temporary strengthening of end portals are made, that the bridge could be re-opened at a weight limit of 3 Tons under emergency conditions if area roads are flooded and a temporary opening best serves the citizens of Lane County;

NOW THEREFORE, BE IT ORDERED, that the Director of Public Works decision to close the bridge is confirmed; **FURTHER ORDERED**, that the County Engineer's provide temporary strengthening improvements, and re-open the Coyote Covered Bridge at a weight limit of 3 Tons under emergency flooding conditions be authorized as shown on Exhibit A.

DATED this _____ day of _____ 2006.

10-30-06

Bill Dwyer, Chair
Lane County Board of Commissioners

EXHIBIT A