***Abstract:***

*Two compression and two bending tests using X80 high-strain line pipes with 30 inches (762 mm) in outside diameter were conducted to investigate its compression capacity and bending capacity. The compression test revealed that the pipes had the critical compressive strain of 0.90 and 0.78% and the bending test clarified that the 2OD (two times outside diameter) average critical compressive strains were 2.40 and 2.15% and the 1OD average were 2.67 and 2.28%, respectively. The test results proved that X80 high-strain linepipes satisfy requirements from pipeline projects and ensure pipeline integrity in seismic and permafrost areas.*

## 1. Introduction

The e a f g-d a ce ah gh- e e ga e e ec e ea a e e a g he ec f c ed c b he a ca f h gh- e g h e e [1]. Whe e e a e c c ed

e ea he b . The a e def a a e a b e ed e e C-2.

The he e f e e C-1 b a ed he FEA h **Fig. 4**. The ef -ha d a d gh -ha d g e h he e f he ca c a ha eg ec he ge e c e fec (OD + WT) a d ha a a e f d f he e a e a a g e f he a e g h f he e e a d d ca e a a e age be d g a e a e he a e e g h.

A h he g e , he c ca be d g e a d a e age be d g a f e e B-1 e e 5.08 MN a d 1.85%, e ec e , h e h e f B-2 e e 5.80 MN a d 1.65%. The c ca be d g e f B-1 a 22% a e ha ha f B-2, a d he a e age be d g a f B-1 a 20% a ge ha ha f B-2.

### 4.2 Finite Element Analyses of the Bending Tests

Te e B-1 a d B-2 e e de ed g f - de he e e e b he a e e h d a ed he FEA f he c e e e (C-1 a d C-2). The d ded e e e f B-1 a d B-2 e e he a e a h e f C-1 a d C-2. The ee e e f he e a a- a a de ed b f - de he e e e a d he e a a de ed b bea e e e .

#### 4.2.1 Finite element analysis of test pipe B-1

F g e 5 h he e f FEA h ch a g e ge e c e fec a c de ed f e e e 1-AACa*CaA.07Ca,A.A.;- X G6X E5DCe-Q.Q-.Q-**..STD X-BAA6' .A6'C C ...')1C E5D e11*H 1C *1.A6'C *A6'C STI a he he e b e ed he be d g e h Ph 4.

### 4.4 Average Critical Compressive Strain

I Sec 4.2 ab e, he a ca ac f a X80-HSLP LP ba ed he be d g e e ed a he a e age c ca be d g a . I h ec , h e e, e e e he a ca ac g he a e age c ca a , a a e age f he c e e a . **Figure 11** h he e a h a g be d g a , c e-e a , a d e e a a ec f e e B-1 e c e a he e.

The a e age c ca c e e a ge e a ed he he ga ge e g h de ed a he a e g h ($L$) e e ed a $\varepsilon_{c\,L}$ . The a e age c ca c e e a ge e a ed he he ga ge e g h he e-de d a e e (1D) a d ce (2D) a e e e ed a $\varepsilon_{c\,D}$ a d $\varepsilon_{c\,2D}$, e ec e .

The a e f he a e age c ca c e e a ($\varepsilon_{c\,L}$ , $\varepsilon_{c\,2D}$, $\varepsilon_{c\,D}$) b a ed he be d g e f e e B-1 e e 1.91%, 2.40%, a d 2.67%, e ec e . I he FEA, he c e a e h gh-acc ac e e e b a ed e e he he (OD + WT + BL) e-fec e e c de ed, a d he a e f he c ca a e age c e e a e e 2.01%, 2.28%, a d 2.40%. A a a e f h e , he a e age c -ca a c ea e a he ga ge e g h dec ea e .

The a e f a e age c ca c e e a ($\varepsilon_{c\,L}$ , $\varepsilon_{c\,2D}$, $\varepsilon_{c\,D}$) b a ed he be d g e f e e B-2 e e 1.85%, 2.15%, a d 2.21%, e ec e . The a e f he a e age c ca c e e a b a ed he he (OD + WT + BL) e fec e e c d-e ed e e 1.84%, 2.12%, a d 2.21%. A h e e B-1, he a e age c e e c ca a c ea ed a he ga ge e g h dec ea ed. Beca e he YS/TS f e e B-2 a ge ha ha f B-1, he a e age c ca c e e a f B-2 a a e ha ha f B-1.

T he ca c a e f he FEA e a ed e e B-1 a d B-2, e c c de ha e ca acc -a e e a e he a ca ac f e h a d be d g b c de g e ge e c e fec-, c d g a WT e fec . Th ee c b a f ge e c e fec ca be 2(a)-12( )-12( )-17(b)-12(e)-12(

e ec e .

(2) The effec f ge e c e fec he a ca ac f he e e h a d be d g a d he -b c g beha f he e e a e a ab e.

(3) The a be d g e a d a e age c ca a f e ca be e a ed h g d acc ac b c de g c b a f ge e c e fec , f e a e, (OD + WT) e fec- , (BL + WT) e fec , a d (OD + WT + BL) e fec .

A de c bed ab e, h gh- a e e ha e e ce e a ca ac h a d c e a d be d g, a d a e effec e e g he eg f e e e c a ea a d e af a ea .

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