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June 14, 2021

Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Subject: Error Notification for Level 4 Bug

Dear Sir/Madam:

Enclosed please find a level 4 bug (BER Report No. B6.0-276) found in PD and EPD STRUDL and its detailed description. Only page 1 of 3 is enclosed. Pages 2 and 3 are not applicable to the reporting. This bug is not fixed. The user should stop using capabilities associated with this bug as described in the bug description until further notice.

Per Phi-Delta's Quality Assurance Procedures, a level 4 bug is defined as a bug in STRUDL program due to which an intended solution is produced incorrectly and incorrect results are produced. However, the incorrectness of the results is not obvious to the user.

Please note that 10CFR21 is applicable to this bug and the program application MUST be evaluated accordingly.

Please further note that the signed Certified Mail Receipt will be used as the acknowledgement that you have received this notice.

Should you have any questions or need more clarification, please do not hesitate to contact this office, Via Phone (781) 834-5279, or via
E-Mail @ PHIDELTA10@AOL.com.

Thank you.

Sincerely,

Som P. Virk

Som P. Virk, PhD

CC: VPF, QA File

encl.

PHI-DELTA BUG/ENHANCEMENT/ERROR REPORT
(BER)
(Page 1 of 3)

BER REPORT NO. B6.0-276

APPLICABLE PROGRAM PRODUCT:

PD STRUDL X E/PD STRUDL X OTHER _____

REPORTER: AEP (AYP) DATE: 1/1/2021

RECORDER: PD (SPV) DATE: 1/1/2021

PLATFORMS AFFECTED: ALL: ____ IBM: X VAX: X PC: X

OTHER (IBM RISC, SGI): _____

VERSION(S) AFFECTED: All versions since 1992
(if an enhancement, complete at time of release)

DESCRIPTION:

Under certain conditions, results of PD/EPD STRUDL capability, The Multiple Response Spectrum Loading Analysis, also known as Independent Support Motion (ISM), are non-verifiable. This capability is described in PD STRUDL Users' Manual, Section 5.7.1.1.2, Volume 1.

(See Section (1) of the attached Supplement to PD STRUDL Bugs B6.0-275 and B6.0-276)

IF A BUG,

LEVEL # 4

SIGNATURE (VPF) [signature] DATE 6/14/2021

IF BUG IS OF LEVEL 4, IS 10 CFR PART 21 APPLICABLE? YES X NO _____

CONDITIONS UNDER WHICH IT OCCURS:

See Section (3) of the attached Supplement to PD STRUDL Bugs B6.0-275 and B6.0-276

CIRCUMVENTIONS, IF ANY:

See Section (4) of the attached Supplement to PD STRUDL Bugs B6.0-275 and B6.0-276

Supplement 1 To PD STRUDL Bugs B6.0-275 and B6.0-276

Section 1: Historic Background of Bug B6.0-275 and B6.0-276

On January 16, 2020, American Electric Power (AEP) submitted a PD STRUDL Piping System Run (S115) to Phi-Delta (PD) and identified the following two (2) concerns:

a. During the analysis, an Error Message – " DISPLACEMENT LOAD IN LOADING CONDITION xx1 IS APPLIED TO JOINT xx2 IN RELEASED DIRECTION(s) " - appears randomly. Why?
b. The results produced by the ISM analysis do not appear to make sense. Why?

Concern (a) was entered by PD into its BER book as B6.0-275. During examination of bug B6.0-275, the reasons for the random appearance of the Error message were identified and the bug is fixable even though it has not been fixed yet. It is scheduled to be fixed in the next PD STRUDL Release. This bug is labeled as of Level 2 and is not reportable.

However, during further examination (See Section 2 of this Supplement) of bug B6.0-275, it was discovered that under certain condition(s), the results produced by the ISM capability in PD STRUDL were unpredictable and cannot be verified at present. It has not yet been determined whether the results are incorrect. Neither it has been determined whether the results are conservative or unconservative. This discussion lends itself to Concern (b) identified by AEP above. This concern of unpredictable and non-verifiable results has been entered by PD into its BER book as Bug B6.0-276. This bug is labeled as of Level 4 and is Reportable. After completing examination of the reason(s), solution(s), if any, and verifiability of the results, etc., in Section 2 of this Report, it will be determined whether PD wants the ISM capability in PD STRUDL to be continued. If not, the proper error messages will be added and the execution of the analysis will be stopped. This will be completed in the next PD STRUDL Release.

Section 2: Discussion of Multiple Response Analysis in PD STRUDL

The examples in this document are used to test and verify the functionality of Multiple Response Analysis capability in PD STRUDL. The restriction(s), if any, are also pointed out.

The example employs a straight beam divided into 5 equal segments. It contains 6 joints (1 to 6) and 5 beam elements (1 to 5). The beam lies in an arbitrary plane. It starts at joint 1 and ends at joint 6. The beam elements start as member 1 (1-2) and end at member 5 (5-6). Joint 1 is a rigid support. Joint 6 is rigid but changes to RELEASED and/or ELASTIC support. The cross-sectional properties in property Y direction are different than those in direction Z. That is, IY is different than IZ.

In some examples, an additional joint (7) is created along the positive global X axis at a small distance from joint 6. Support Status from joint 6 is removed and is assigned to joint 7. A new space frame member (6) is created between joints 6 and 7. The elastic support properties from joint 6 are assigned as member properties to member 6 using the STIFFNESS MATRIX DIAGONAL

option of the MEMBER PROPERTIES Command. In other cases, member 6 is defined as NONSTANDARD MULTI SPRING member. The elastic properties of the support are transferred as stiffness properties of the Nonstandard Multi Spring Member. The advantage of the latter is that it can be code checked.

Two spectras are considered, namely, 1 and 6. Spectra 1 is twice as strong as spectra 6.

Many Joint conditions were tested. Each condition was tested in several different ways. The original AEP test cases, the test cases produced in this Section, and many other test cases used for examining this bug are placed on PD computer(s) drive C, directories B6.0-276A, B6.0-276B and B6.0-276C.

Section 3: Conditions Under Which Bug B6.0-276 Occurs

The bug occurs when the Independent Shock Load is applied to a Support Released joint with:

a) Theta angles and/or
b) elastic springs

The application part is described in PD STRUDL Users' Manual, Volume 1, Section 5.7.1.1.2, subsection (b). The application joint is identified in the COMPONENT SHOCK LOAD Command as "idc".

Section 4: Circumvention(s), if Any

The circumvention(s) are available for the elastic spring condition. They are discussed in Section 2, paragraph 3, of this document. The circumventions for the rotations (thetas) are being examined. The circumventions for the latter, if found, will be made available on a later date.

Section 5: Current Conclusion for Bug B6.0-276

As for any bug in PD STRUDL identified by PD as of Level 4, the user is asked to stop using the ISM capability until further notice.