/3106380/2024

Issued by email on 07.10.24

.भारत सरकार **GOVERNMENT OF INDIA**
रेल मंत्रालय **MINISTRY OF RAILWAYS**
(रेलवे बोर्ड **RAILWAY BOARD)**
*****

No. 2023/48/CE-III/BR/3000 MT (e-Office No. 3448988) New Delhi. Dated 04.10.2024

The General Managers,
All Zonal Railways.

Sub:- Residual Fatigue assessment of steel bridges for running of Heavier Axle Loads

Ref:- (i) Railway Board's letters No. /48/CE-III/BR/3000 MT (e-3448988) dated 04.06.2024 & 14.06.2024
(ii) Advance Correction Slip No. 42 to IRBM dated 22.07.2024

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Attention is invited to Board's above referred letters on the captioned subject and it is reiterated that vide letter No.2023/48/CE-III/BR/3000 MT (e-3448988) dated 04.06.2024, PCEs of All Zonal Railways were advised to carry out residual fatigue life analysis in case of bridges which are more than 50 years old and bridges on High GMT routes (> 40 GMT) on priority. This exercise is essentially required to be undertaken to identify the vulnerable bridges for extensive monitoring & predictive maintenance.

2. Thereafter, vide ref. (i) dated 14.06.2024, it was instructed that the residual fatigue assessment of steel bridges for running of Heavier Axle Load be completed within 45 days (i.e up to 30.07.2024). Further, a phase wise assessment methodology as detailed in ACS-42 of IRBM was to be followed for assessment and taking follow up action.

3. Adequate training has been arranged through RDSO & IRICEN on the subject to the concerned officials but still fatigue life assessment of bridges qualifying the eligibility criteria has not been completed.

4. Therefore, the matter may kindly be monitored at your level so as to ensure long term safety and sustainability of the bridges on high GMT routes of your railway.

Signed by
Ravindra Kumar Goel
Date: 05-10-2024 14:37:29

(Ravindra Kumar Goel)
Principal Executive Director/Bridge
Ph. No. 011-478-45452

Copy to:-

1. DG/Safety for kind information
2. PCE/All zonal Railways for information and necessary action.

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)
*****

No. 2023/48/CE-III/BR/3000 MT (E-3448988) New Delhi dated 04.06.2024

Principal Chief Engineer,
All Zonal Railways.

Sub: Residual Fatigue assessment of steel bridges for running of Heavier Axle loads.

Ref: 1. RDSO letter No. CBS/25t Axle Load dated 15.03.2023 – Suitability of bridges for running 25t loading – 2008 at 100 kmph on DFC feeder routes and 25t identified routes.
2. RDSO letter No. CBS/25t Axle Load dated 20.04.2009 – Guidelines for checking the suitability of existing drawings of BGML/RBG/MBG/HM loading for 25t loading – 2008.
3. RDSO report on Assessment of Residual Fatigue Life of Br. No.-586 near Koraput, East Coast Railway (BS-107).
4. RDSO Guidelines for Assessment of Residual Fatigue Life of steel girder bridges (BS-91).
5. RDSO Guidelines BS 106 R2 -Guidelines for Instrumentation of Bridges. (Rev- 2)

Steel Girder Bridges are subjected to heavy fluctuating stresses causing fatigue in steel. This may lead to the failure of member or connection at the stress level much below the maximum stress for which the member/connection has been designed under static loads. The phenomenon of fatigue was not correctly understood earlier and most of the old bridges have been designed without adequate safeguards against fatigue. IRS Steel Bridge Code-1962 contained provisions for fatigue which were based on stress ratio concept and have been rendered obsolete as new fatigue provisions based on concepts of stress range, GMT factor, configuration of truss, loading & design life etc. have been introduced in 2012. With increase in axle loads & speeds, the bridge is subjected to **cycles of higher stress ranges** and fatigue life of individual members/ components gets consumed early, affecting overall residual fatigue life of the bride. Heavier axle loads such as 25 t loading, CC+6+2 and CC+8+2 have already been permitted on some of the routes. Few cases of failure of bridge components in recent past have been reported on such routes in one of the railway where annual GMT has suddenly increased.

2. Therefore, all the bridges, more than 50 years old, need to be assessed for their residual fatigue life. The estimation of residual fatigue life of a bridge depends on the

... contd.

04/06/2024

accuracy of past traffic data and future projections. The initial assessment can be made with simplified approach as given Annexure -G (for Fatigue) in IRS Steel Bridge Code (Reprint –2017). Guidelines / instructions for making **residual fatigue life assessment** are already given by RDSO vide Ref. (1), (2) & (3) above.

3. **Bridges on High GMT routes (say > 40 GMT)** shall be assessed on priority to ensure availability of sufficient residual fatigue life of bridge components. Appropriate instrumentation and health monitoring may be planned in consultation with RDSO as per the requirement based on the outcome of the assessment.

4. Further action shall be planned for re-girdering/ rebuilding based on the outcome of the above assessment.

04/06/2024

(Ravindra Kumar Goel)
Principal Executive Director/Bridge
Ph. No. 011-478-45452

Copy to:-

1. DG, IRICEN for information please.
2. PED/Infra-II and ED/B&S RDSO for guiding the railways in assessment of residual fatigue and compiling the results for taking further necessary action.
3. CBEs/All Zonal Railways for information and necessary action please.

Issued by bmcell on 18.06.2024

2023/48/CE-III/BR/Mission3000MT

I/3098020/2024

भारत सरकार GOVERNMENT OF INDIA
रेल मंत्रालय MINISTRY OF RAILWAYS
(रेलवे बोर्ड RAILWAY BOARD)

No.2023/48/CE-III/BR/3000 MT (E-3448988) **New Delhi, dated 13.06.2024**

18

Principal Chief Engineer,
All Zonal Railways.

Sub: - Residual Fatigue assessment of steel bridges for running of Heavier Axle loads.

Ref: - Board letter No. 2023/48/CE-III/BR/3000 MT dated 04.06.2024.

*****

Kindly refer to the Board's letter under reference above at ref. (i) on the captioned subject in which Residual Fatigue assessment of steel bridges for running of Heavier Axle loads is to be done in following conditions:

a. All the bridges, more than 50 years old, need to be assessed for their residual fatigue life. The estimation of residual fatigue life of a bridge depends on the accuracy of past traffic data and future projections.
b. Bridges on High GMT routes (say > 40 GMT) shall be assessed on priority to ensure availability of sufficient residual fatigue life of bridge components. Appropriate instrumentation and health monitoring may be planned in consultation with RDSO as per the requirement based on the outcome of the assessment.

As per BMS, the total no. of steel bridges, more than 50 years old is 2752 nos and a google sheet is prepared & circulated for monitoring. It is requested that the Residual Fatigue assessment of steel bridges for running of Heavier Axle loads shall be completed within 45 days and intimated to the Board's office on priority basis through e-mail at bmcellrb@gmail.com.

https://docs.google.com/spreadsheets/d/1Cr3E4XWhYXh7vS2oSjb9sr4ONGE7v8Cm/edit?usp=sharing&ouid=101130874854381509262&rtpof=true&sd=true

DA: As Above

Signed by Niraj Kumar
Date: 14-06-2024 18:36:51
Reason: Approved

(Niraj Kumar)
Executive Director Civil Engg./B&S
Phone No. 011-47845474

Copy to:- CBEs/All Zonal Railways for information & necessary action please.

I/3098020/2024

Room No. 109-A, Rail Bhawan, New Delhi-110001.

Assessment of Residual Fatigue life of Steel Bridges

Railway Board letter No. 2023/48/CE-III/BR/3000 MT (E-3448988) dated 04.06.2024							
SN	Railway	Scope of Steel Bridges for Fatigue Assessment (more then 50 year old Bridge)		No. of Bridges Fatigue Assessment done	No. of Bridges Fail in Residual Fatigue	No of Bridges Balance for Fatigue Assessment	TDC (Assess the Residual Fatigue as per Scope)
		As per BMS	As per Zonal Railway				
1	CR	146					
2	ER	211					
3	ECR	247					
4	ECoR	140					
5	NR	177					
6	NCR	13					
7	NER	89					
8	NFR	450					
9	NWR	24					
10	SR	196					
11	SCR	188					
12	SER	213					
13	SECR	130					
14	SWR	74					
15	WR	220					
16	WCR	234					
Total		**2752**	**0**	**0**	**0**	**0**	**0**

विनय कृष्ण पाण्डेय
Vinay Krishna Pandey
कार्यकारी निदेशक/पु० एवं सं०-II
Executive Director/B&S-II

सत्यमेव जयते

भारत सरकार -रेल मंत्रालय
अनुसन्धान अभिकल्प और मानक संगठन
लखनऊ.226011
Government of India-Ministry of Railways
Research Designs & Standards Organisation
Lucknow- 226011
Phone/ Fax : 0522-2465704
Email : edbns2rdso@gmail.com

संख्या: CBS/IRBM

दिनांक: 22.07.2024

Principal Chief Engineers:

1. Central Railway, Mumbai CST - 400001
2. Eastern Railway, Fairlie Place, Kolkata - 700001
3. East Central Railway, Hazipur - 844101
4. East Coast Railway, Bhubaneshwar - 751016
5. Northern Railway, Baroda House, New Delhi - 110001
6. North Central Railway, Allahabad - 211001
7. North Eastern Railway, Gorakhpur - 273001
8. Northeast Frontier Railway, Maligaon, Guwahati - 781061
9. North Western Railway, Jaipur - 302001
10. Southern Railway, Park Town, Chennai - 600003
11. South Central Railway, Rail Nilayam, Secunderabad - 500371
12. South East Central Railway, Bilaspur - 495004
13. South Eastern Railway, Garden Reach, Kolkata - 700043
14. South West Railway, Hubli - 580023
15. Western Railway, Mumbai - 400020
16. West Central Railway, Jabalpur - 482001
17. Metro Railway, Jawaharlal Nehru Road, Kolkata – 700071

विषय : **Advance Correction Slip No. 42 to Indian Railway Bridge Manual.**

संदर्भ : EDCE/B&S/Railway Board's letter No.2023/3/CE-III/BR/87th BSC, dated 18.07.2024.

On above subject, Advance Correction Slip No.42 of Indian Railway Bridge Manual regarding Residual Fatigue Life Assessment of old steel girders, duly approved by Railway Board vide letter under reference, is enclosed for information and necessary action please.

Receipt of this letter may please be acknowledged.

संलग्नक: As above.

22/7/24

(वी.के. पाण्डेय)
(V. K. Pandey)
कार्यकारी निदेशक/पु०एवंसं०-II
Executive Director/B&S-II

प्रतिलिपि:

(A)
1. Additional Member (Civil Engg.) Railway Board, Rail Bhawan, New Delhi - 110001
2. Additional Member (Works) Railway Board, Rail Bhawan, New Delhi - 110001
3. Principal Executive Director/Bridges, Railway Board, Rail Bhawan, New

Delhi - 110001
4. Director General, Indian Railway Institute of Civil Engg., Pune - 411 001
5. Executive Director Civil Engg./B&S, Railway Board, Rail Bhawan, Room No.140A, New Delhi - 110001
6. General Manager (C), N. F. Railway, Maligaon, Guwahati - 781001
7. The Director General, National Academy of Indian Railways, Vadodara – 390004
8. The Vice Chairman, Rail Land Development Authority, Unit No.702-B, 7th Floor, Konnectus Tower-2, DMRC Building, Ajmeri Gate, Delhi-110002
9. General Manager (Engg.) ICF/Channai, RCF/Kapurthala, DLW/Varanasi, CLW/Chittranjan, W&AP/ Yelahanka, Bengaluru & DMW/Patiala.
10. Director General, IRICEN, 11 A South Main Road, Koregaon Park, Pune 411001.
11. Director General, IRIEEN, Post Box 233, Nasik Road- 422101, Nasik, Maharashtra
12. Director General, NAIR, Lalbaug, Vadodara - 390004, Gujarat.
13. Director General, IRITM, Manak Nagar, Lucknow.
14. Genl. Secy., AIRF, NFIR, IRPOF, FROA, AIRPFA, DAI (Railways) Rail Bhawan, New Delhi.

(B) The Chief Administrative Officer (Construction):

1. Central Railway, Mumbai CST - 400001
2. Eastern Railway, Fairlie Place, Kolkata - 700001
3. East Central Railway, Mahendrughat, Patna (Bihar) - 800004
4. East Coast Railway, Bhubaneswar, (Orissa) - 751016
5. Northern Railway, Kashmere Gate, Delhi - 110006
6. USBRL Project, Northern Railway, Satyam Complex, Trikuta Nagar Extn., Jammu 180020
7. North Central Railway, Allahabad, (U.P.) - 211001
8. North Eastern Railway, Gorakhpur - 273001
9. North Western Railway, Jaipur, (Rajasthan) - 302001
10. Southern Railway, Egmore, Chennai – 600008
11. South Central Railway, DRM/Secunderabad Office Compound, Secunderabad -500 371
12. South Eastern Railway, Garden Reach, Kolkata – 700043
13. South East Central Railway, Bilaspur - 495004
14. South Western Railway, No. 18 Miller Road, Bangalore, (Karnataka) – 560046
15. Western Railway, Mumbai - 400020
16. West Central Railway, Jabalpur (M.P.) - 482001
17. CAO-I, II & III, Northeast Frontier Railway, Maligaon, Guwahati - 781011
18. CAO/ERS, Southern Railway, Ernakulam, Kerala – 682506

(C) Chief Bridge Engineers:

1. Central Railway, Mumbai CST- 400001
2. Eastern Railway, Fairlie Place, Kolkata - 700001
3. East Central Railway, Hazipur - 844101
4. East Coast Railway, Bhubaneshwar - 751016
5. Northern Railway, Baroda House, New Delhi - 110001
6. North Central Railway, Allahabad - 211001
7. North Eastern Railway, Gorakhpur - 273001
8. Northeast Frontier Railway, Maligaon, Guwahati - 781061
9. North Western Railway, Jaipur - 302001
10. Southern Railway, Park Town, Chennai - 600003
11. South Central Railway, Rail Nilayam, Secunderabad - 500371

12. South East Central Railway, Bilaspur - 495004
13. South Eastern Railway, Garden Reach, Kolkata-700043
14. South West Railway, Hubli - 580023
15. Western Railway, Mumbai - 400020
16. West Central Railway, Jabalpur - 482001
17. Metro Railway, Kolkata – 700071

(D) Commissioner of Railway Safety:

1. Chief Commissioner of Railway Safety, N.E. Railway Office Compound, Ashok Marg, Lucknow – 226002
2. Central Circle, 2nd Floor, Churchgate Station Building Mumbai - 400020
3. Eastern Circle, Multistoreyed Building of Eastern Railway, 12th Floor, Strand Road, Kolkata - 700001
4. Northern Circle, near Centre for Railway Information System, Safdarjung Railway Station, New Delhi - 110021
5. North Eastern Circle, DRM Compound, Northern Railway, Hazratganj, Lucknow - 226001
6. Northeast Frontier Circle, 12 Strand Road, Multistoryed Building of Eastern Railway, Kolkata - 700001
7. Southern Circle, 7 Seshadri Road, Gandhi Nagar, Bangalore - 560009
8. South Central Circle, Opp. Rail Nilayam, Sarojini Devi Road, Secunderabad - 500071
9. South Eastern Circle, 14 Strand Road, Multistoryed Building of Eastern Railway, Kolkata-700001
10. Western Circle, 2nd Floor, Churchgate Station Building Annexe, Maharishi Karve Road, Mumbai-400020.

(E) Railway PSUs & Others:

1. The Managing Director, RITES LTD, RITES Bhawan, Plot No.1, Sect.29, Gurgaon (Haryana) - 122001
2. The Managing Director, IRCON, Palika Bhawan, Sector-XIII, R.K. Puram, New Delhi - 110066
3. The Chairman & Managing Director, Konkan Railway Corporation Ltd., Belapur Bhavan, Plot No. 6, Sector-II CBD Belapur, Navi Mumbai - 400614
4. The Managing Director, Rail Vikas Nigam Ltd., Ist floor, August Kranti Bhawan, Bhikaji Coma Place, Africa Road, R.K. Puram, New Delhi - 110016
5. The Managing Director, DFCCIL, 5th Floor, Pragati Maidan, Metro Station Building Complex New Delhi - 110001
6. The Managing Director, Delhi Metro Rail Corporation Ltd., NBCC Place, Bhishma Pitamah Marg, Pragati Vihar, New Delhi – 110003
7. Chairman & Managing Director, CONCOR, Concor Bhawan, C-3, Mathura Road, Opp. Appolo Hospital New Delhi - 110076.
8. Chairman & Managing Director, (MRVC), 2nd Floor, Churchgate Station Building, Churchgate, Mumbai - 400020.
9. Managing Director NHSRCL, Asia Bhavan, Sector 9, IInd Floor, Road No. 205, Dwarka Delhi.
10. Managing Director, Pipavav Rail Corporation Ltd, B 1202, B Wing, 12th Floor, Statesman House, 148 Barakhamba Road, New Delhi-110001.

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(Railway Board)

Indian Railways Bridge Manual – 1998

ADDENDUM & CORRIGENDUM SLIP No. 42 dated 22.07.2024

Following amendments are issued in IRBM:

212A. Residual Fatigue Life Assessment of old steel girders:-

As per new codal provisions of IRS Steel Bridge Code, fatigue life of girder components, depends on the Gross Million Tons of traffic (GMT) carried and the type of loading permitted over the bridges. Residual fatigue life assessment of old steel girder bridges, designed with old codal provisions, shall be made in a phased manner as per **Annexure 2/17.**

1. All bridges on routes, having annual GMT of 40 and age more than 50 years shall be systematically assessed for residual fatigue life and planned for extensive monitoring till retrofitting or replacement.
2. Restrictions of loading & speed or both shall be imposed, if the residual fatigue life is found inadequate. On such bridges, instrumentation may be carried out for continuous monitoring of the critical members to detect imminent fatigue cracks, initiating from the rivet holes & hidden under the rivet heads.
3. Ultra Sonic Flaw Detection (USFD), Acoustic Emission Technique (AET) and Oscillation measurements etc. may be used for determining the proper scheme of instrumentation in consultation with RDSO.

BY ORDER

22/07/24

(वी. के. पाण्डेय)
(V. K. Pandey)
कार्यकारी निदेशक/पु०एवंसं०-II
Executive Director/B&S-II

LUCKNOW
Dated: 22.07.2024

ASSESSMENT OF RESIDUAL FATIGUE LIFE OF OLD STEEL GIRDERS

The residual fatigue life assessment shall be carried out systematically as illustrated in Figure-1 and described below. For notations and methods of analysis IRS Steel Bridge Code (Updated) shall be referred.

Phase- I Preliminary Evaluation

The aim is to remove existing doubts about safety of the structure using fairly simple methods and identify critical parts or members in the structure. This is performed by gathering information on the structure from drawings and design computations, carrying out a site visit, etc. The assessment is carried out by the engineer alone by using current codes and by making conservative assumptions where information is lacking or doubtful. Factor of safety against fatigue shall be worked out which should be more than one.

Phase- II Detailed investigation

The detailed investigations are carried out if the factor of safety against fatigue determined in Phase-1 is less than one. The aim is to update information and to carry out refined assessments only for those members where safety is not ensured. This is done by doing quantitative inspections and using detailed analytical procedure based on collection of actual traffic data, actual speeds, updated values for loads, sectional properties of members as well as more accurate models of analysis. Here, in addition to the engineer, services of specialized firm, agency or individual experts are generally required. If there are still doubts left about the sufficient residual fatigue life, expert investigations are to be called for.

Phase-III Expert investigation

For problems with large consequences in terms of risks or of costs related to a decision, a team of experts should be called in order to check carefully the conclusions and proposals reached in Phase II. Discussions and further assessments using specific tools (field observation of stresses by instrumentation, probabilistic methods, fracture mechanics, etc.) can also be carried out to help in reaching decisions. Detailed investigations using time history of stresses measured and stress range histograms derived can be done by employing Palmgren - Minor rule of cumulative damage to arrive at a more sophisticated estimate of residual fatigue life. In case, residual fatigue life is still insufficient, remedial measures are to be taken as per Phase-IV.

Phase-IV Remedial measures

The aim is to propose measures to have a fit for service structure with sufficient safety. Different measures can be taken, such as:

1. Intensify monitoring

2. Reduction of loads or change in use
3. Repair or rehabilitation
4. Strengthening to sustain till re-girdering or rebuilding

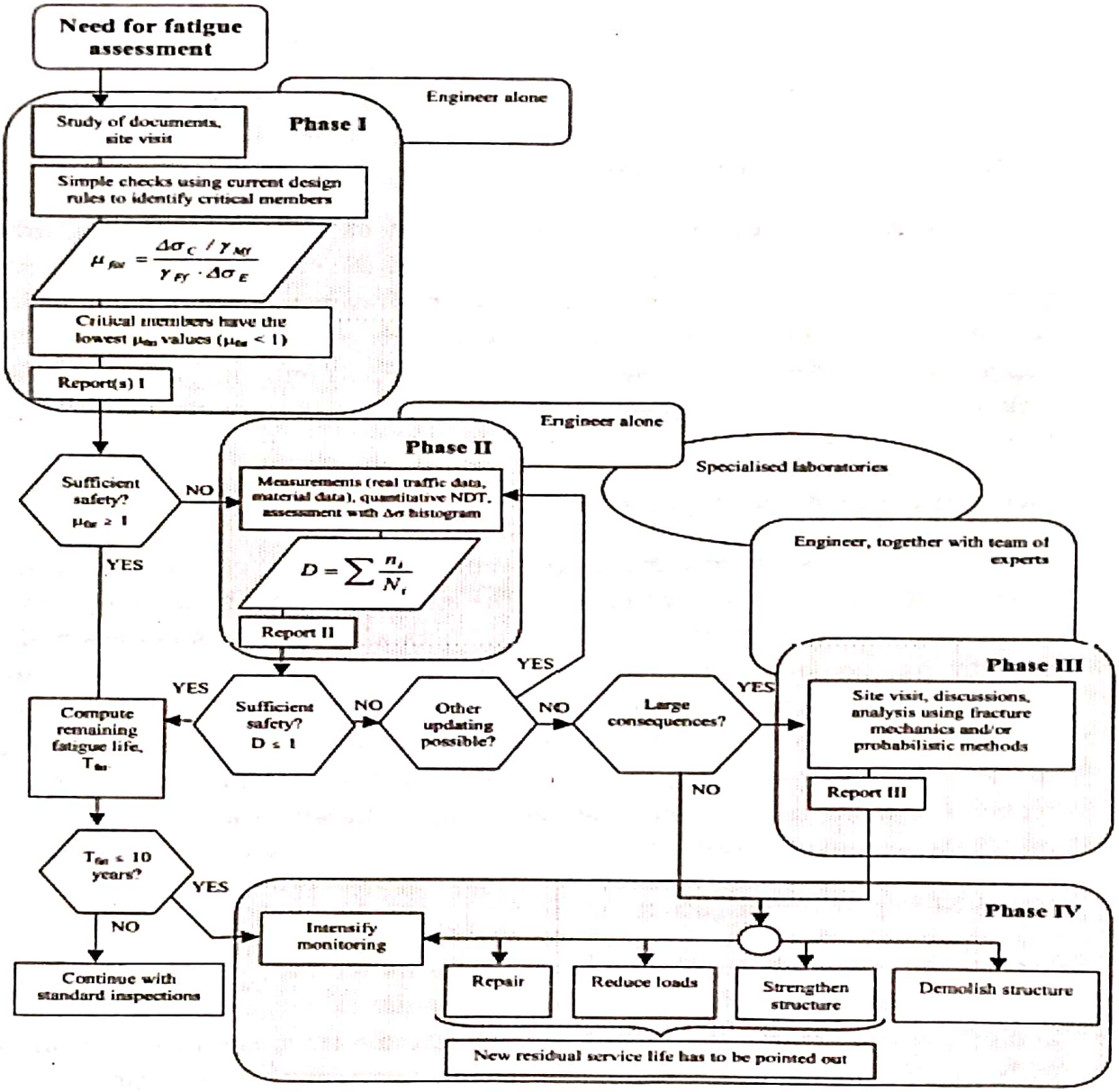

Figure-1

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