# Prestressed concrete problems and solutions pdf

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It took minutes © 1920 and 30s for the development of materials to progress to a Navel in prestressed concrete it could be used with confianÃ§a. Freyssinet in FranÃ§a, Magnel in BÃ © Hoyer logic and Germany were the main developers. The idea PRA © -esforÃ§o, tamba © m has been applied to many other forms, such as: Ã £ © wave of the wheels; Ã ¢ Ã ¢ riveting; Barrels Ã ¢, Ã © i.e., coma © commerce Coopers; In these cases heated metal Ã © made to fit only one object. When the metal cools it contracts induce prÃ © -esforÃ§o the object. 4. Civil Engineering Design (1) Dr. C. Caprani4 1.2 PrincÃpio BÃ¡sico PRA © -esforÃ§o Example BÃ¡sico Example Diary clÃ¡ssica PRA © Ã © -esforÃ§o this: A row of books can be lifted by squeezing the wings: the structural explicaÃ§Ã £ Ã © line of books that have traÃ§Ã capacity £ zero. Therefore, the beamÃ ¢ Ã ¢ of books on the £ ATA © can even take your prÃ³prio weight. To overcome this, provide a voltage £ external starting (the prÃ © -esforÃ§o) which compresses the books together. Now they can separate-Only if the voltage £ £ traÃ§Ã induced prÃ³prio the weight of the books © larger than the DAR © £ -esforÃ§o compress the introduced. Beta £ â © £ very strong in the Compression but weak in the voltage £. In a common concrete beam voltage to the £ £ traÃ§Ã the bottom: 5. Civil Engineering Design (1) Dr. C. Caprani5 sÃ £ taken by the reforÃ§o of aÃ§o Padra £ o: But you will still get cracks, which due to both flexa © £ o shear: in prestressed concrete, because PRA © © -esforÃ§o blanket mo concrete in the Compression £ without cracking occurs. This Ã © often preferÃvel where durability Ã © one preocupaÃ§Ã £ o. 6. Civil Engineering Design (1) Dr. C. Caprani6 1.3 Concrete Prestressed Advantages The main advantages of prestressed concrete (PSC) sÃ £ o: less secÃ§Ã £ sizes Since the PSC uses the £ secÃ§Ã Beta £ all, the second moment of Ã¡rea Ã © greater and therefore the secÃ§Ã £ â © harder Smaller deflexÃµes greatly reduces deflexÃµes for a given size secÃ§Ã the £. Increase covers size £ seÃ§Ã the lowest reduces the self weight. Thus, a certain seÃ§Ã £ o can be extended further with the beta £ prÃ © -esforÃ§ado than it can with ordinary reinforced concrete. Durability since all secÃ§Ã £ Compression in the remains of the £ without fissuraÃ§Ã the £ £ o can occur and therefore there is little penetraÃ§Ã the £ coverage. This greatly improves the long-term durability of structures, especially bridges as excavation © m means that the tanks beta £ can be done as waterproof as aÃ§o tanks with greater durability. An Ar RC PSC 7. Civil Engineering Design (1) Dr. C. Caprani7 1.4 concrete materials The main factors used in the Beta £ £ sÃ £ o the PSC: a ¢ Ã ¢ BETA the ordinary Portland cement-based © used forÃ§a but generally greater than 50 N / mm2; Ã ¢ Ã ¢ Initial Resistance high, the © Required to allow the rÃ¡pida aplicaÃ§Ã £ © PRA -esforÃ§o; Ã ¢ Ã ¢ greater elasticity of Module A © Required to reduce the shortening member; Ã ¢ Ã ¢ a mixture which reduces the BETA deformaÃ§Ã £ £ to minimize the losses PRA © -esforÃ§o; See deformaÃ§Ã possible Ã £ ¢ INSTANCE the matter is in this CPS from Graphical 8. Civil Engineering Design (1) Dr. C. The Caprani8 aÃ§o used for ARP © -esforÃ Resistance §o has a nominal £ Ã deformaÃ§Ã from 1550-1800 N / mm2. The different shapes can aÃ§o the taking of the £: ¢ Ã yarn: yarn drawn individually from day 7 mm ¢ meter; Ã ¢ parts: a set of threads (7) generally wound together and thus have a meter that day ¢ © different for your area; Ã ¢ £ ¢ the tent: A £ colecÃ§Ã the embedded wires in a conduit used in a tensioning pÃ³s; Bar ¢ Ã ¢: a rod formed aÃ§o especially high endurance greater than 20 mm ¢ day meter. Beta bridge PRA © £ -esforÃ§ado beams typically use milÃmetros 15.7 Day ¢ meter (but with an area of 150 mm2) of 7 super stranded wires having a load of 265 kn. 9. Civil Engineering Drawing (1) Dr. Civil Engineering Caprani9 10. Drawing (1) Dr. C. Caprani10 1.5 METHODS PROSPORT, There are two Methods of Pranel §O: Ã ¢ â € ¢ Imensioning: Apply Pranel Pranel aÃ§o wires before casting concrete; ¬ Ã ¢ Ã ¢-tensioning PÃ³s: applying heat to Prota tendÃµes aÃ§o aft of £ fundiÃ§Ã the concrete. -TensÃ PrÃ © © £ is the most common medium for seÃ§Ãµes prÃ © -moldadas. In EstÃ¡gio 1, the yarn is yarn or the stressed £; In EstÃ¡gio 2, Ã © Launched concrete around the wires / strands stressed; and estÃ¡gio 3, the Prestressed transferred in external anchors for concrete, since it has enough forÃ§a: 11. civil engineering design (1) Dr. C. CAPRANI11 in prÃ © -tensionados members, shed Ã © directly linked to the concrete cast around it. Therefore, the ends of the member, there are a length of £ Transmit wherein the strength of the tape transferred to atravÃ © © s vÃnculo concrete: the ends of members close to many -tensionados ©, S © times necessa ¡ria to debond the vision of concrete. This Ã © to keep tensions within allowed limits, where hÃ¡ little stress induced by yourself with or other charges: 12. Civil Engineering Project (1) Dr. C. Caprani12 PÃ³s-tensioned this mÃ © whole, the concrete already defined, but has it lanÃ§Ã¡ ducts. The yarn or the tendÃµes sÃ £ © are fed atravÃ the ducts (1 EstÃ¡gio) Enta the tensioned (EstÃ¡gio 2) and then anchored to the concrete (estÃ¡gio 3): The anchors to pÃ³s-tensioned members must distribute a large load to the concrete, and must withstand the explosion £ forÃ§as as a result. A lot of common reforÃ§o Ã © often necessary. An anchorage tent £ â © 13. Civil Engineering Design (1) and Dr. C. Caprani13 pÃ³s-tensioning of a tensioned member has reforÃ§o as 14. Civil Engineering Design (1) Dr. C. Caprani14 losses from the time the Prestress Ã © applied Prestress the strength of gradually reduces over time for a navel of balance. The sources of these losses depend on the mÃ © whole by which the protensÃ £ Ã © applied. In both mÃ © all: "The shortened limb due Ã forÃ§ae it relieves some of the Prestress; Ã ¢ â,¬Ã ¢ The concrete shrinks cures addition, Ã ¢ â,¬Ã ¢ The Ã ¢ aÃ§o RelaxesÃ ¬ ¢ ¬ â ¢, Ã © that the stress aÃ§o reduces over time; Ã ¢ ¬ Ã ¢ the chill concrete, i.e. © continues to esforÃ§ar over time. in pÃ³s-tensioning tamba © m hÃ¡ losses due to berth (which may be a sum) and the friction between the duct and tendÃµes as excavation © m imperfections in the initial conducted. Meanwhile the losses will be the £ considered as a percentage of the initial Prestress 15. Civil Engineering Project (1) Dr. C. Caprani15 1.6 uses Prestressed concrete HÃ¡ a large Number of uses:. Ã ¢ â,¬Ã ¢ Permeitadores railway rivers ¡; Ã Ã ¢ ¬ ¢ Centers for Communications; Ã ¢ ¬ Ã ¢ © prÃ -tensionados -tensionados prÃ © Ã ¢ ¬ ¢ HollowcoreÃ slabs; Ã ¢ ¬ Ã ¢ TENSADAS UNITS TENSADAS TENSADAS TENSAIS - £ to go down very long (for example, 16 m £ extension to park the car park ionamento); ¬ Ã ¢ PrÃ © © prÃ -tensionada -tensionada inverted T beam for short bridges perÃodo; ¬ Ã ¢ ¢ PrÃ -tensionou cells PSC prÃ © -tensionadas; ¬ Ã ¢ Ã ¢ portal frame units prÃ © -tensionadas; ¬ Ã ¢ Ã ¢ pÃ³s-tensioned Motorboat with ribs; Ã ¢ £ ¬ Ã ¢ Construction of the balanced cantilever situ - PSC-tensioned pÃ³s; ¬ Ã ¢ â ¬ ¢; ¬ Ã ¢ Ã ¢ ¬ Gegled segmentalÃ ¢ ¬ Ã ¢ â ¬ ¢; ¬ Ã ¢ Ã ¢ PRA segments -condicionados sÃ £ © accompanied by the pÃ³s-tensioning; Ã ¢ â,¬Ã ¢ PSC tank - prÃ © segments -Manufactured pÃ³s-tensioned together on site. TendÃµes circunferÃªncia around the tank; ¬ Ã ¢ Ã ¢ Barges; ¬ Ã ¢ Ã ¢ and more. 16. Civil Engineering Project (1) Dr. C. Caprani16 2. Stresses members Prestressed 2.1 Background The cÃ³digos of prÃ¡tica limit allowed tensions in concrete prÃ © -testado. Most of the PSC of design work involves ensuring that the tensions in the concrete are within the allowed limits. How to deal with tensions allowed only charging of services used © Ã, Ã © i.e., if the SLS. For the SLS case in any seÃ§Ã £ into a member, there are two necessÃ¡rios checks: in transferÃªncia, Ã © when the first concrete feels Prestress. Concrete Ã © less strong, but sÃ¡seÃ§Ã £ o Ã © stronger in transferÃªncia and tensions sÃ £ o only because of the prÃ © -esforÃ§o and Properly. In the service, the stresses induced by loading SLS, in addition to the protective and own weight, should be verified. In the service stage, the concrete has its full force, but the losses will have occurred and so the The force is reduced. The ultimate ability in ULs of PSC section (as for RC) should also be verified. If there is insufficient capacity, you can add reinforcement not -prosted. This often does not govern. 17. Civil Engineering Project (1) Dr. Caprani17 Notice for a Typical Section Prestressed: we have: TZ Section Module, Top Fiber Ti Y =; Section module BZ, lower fiber bi y = "(taken to be negative); TTF allowed tensions of trace in transfer; TCF allowed compressive stress in transfer; STF allowed stress of trace in service; SCF compressive permission of the SCF; TM the moment applied in the transfer; sm the moment applied in service; the proportion of the prosecution after losses (serve (Transfer). 18. Civil Engineering Project (1) Dr. C. Caprani18 Concrete Allowed Tensions has a small resistance to the trait and this can be recognized by the designer. In BS 8110 , there are 3 predicted concrete classes that depend on the level of tracing tensions and cracking allowed: Class 1 class 2 class 3 tension: TTF 1 n / mm2 0.45 CIF for members Tensioned 0.36 CIF to post members -tension attendant Compression: TCF 0.5 cif * Tension: STF 0 n / mm2 0.45 CIF (PRE) 0.36 CIF (POST) See C Table Other Inservice compression: SCF 0.33 CUF * There are other requirements for unusual cases - see the Code 19. Civil Engineering Project (1) Dr. Caprani19 2.2 Basic Principle of the Testrosed Betting Example Consider the basic case of a beam simply supported submitted to a UDL of W KN / M: In this case, we have The Middle Span Moment As: 2 8 C WL M = Also, if we assume a rectangular section as shown, we have the following section Properties: 3 2 2 12 6 6 tb bd a bd i Bd bd zz = = = So, the tension in C are: cc tbbtb mmzz¡¯æ '= = A VB BW LC BD 20. Civil Engineering Project (1) Dr. C. Caprani20 Case i We take the bundle to be constructed of simple concrete (without reinforcement) and neglect the resistance to the (small) concrete traction (0TF =), then, as no traam tension can occur No cargo can be taken: 0i W = Case II We consider the same radius, but with centroid axial parts, as shown: now we have two separate sources of stress: a VB VB BP LCPP + + - + = CT MZC B MZPAC T PMAZ + CB PMAZ "PA 21. THE CIVY ENGRADA IL Project (1) Dr. Caprani21 By failure to occur, the moment caused by the load should induce a stress of tracing greater than the PA. Thus, before failure, we have: 2 2 8 8 C B B I II M P WL Z A Z Z P W L A = = = Note that we take compression as positive and tension as negative. In addition, we will usually take BZ to be negative to simplify the signs. Case III In this case, we place the forces of the print in an eccentricity: using a set of equilibrium of forces as shown, now we have three tensions acting in the section: A VB BW LCPP EE = PM PE = At 22. Civil Engineering Design (1) Dr. Caprani22 Thus, the tensions are: so by failure that we now have: 2 8 C BBB III B MP PE ZE LAZ = + Ã ¢> ¾ = + Ã ¢ Ã¾ Ã¾ Ã¾ Ã¾ ¾ Ã¾ Ã¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ ¾ Ã¾ ZP WW LA BD LA Ã, â € = + = A â € £ â € â € ¢ â € ¢ â € ¢ â € ¢ â € ¢ â € ¢ â € ¢ â € ¢ Ecentricity doubled the allowable service load. + + - + = t pe zb pe zpac tt pm pm pm pm oscz + 'c bb pm pe azz' + - ct mzc b mz + pa 23. Civil engineering project (1) Dr. C. Caprani23 Example NUMBER Ã ¢ â € "No Eccentricity Program Force (in transfer), p = 2500 kn. Losses between transfer and SLS = 20%. Check the tensions. Admissible tensions are: TT F = -1 n / mm2 tc f = 18 n / mm2 SC = 0 n / mm2 SC = 22 N / mm2 The section is rectangular, 300 width and 650 mm depth. It is simply supported covering 12 m with dead load equal to the own weight and a live load of 6 kn / m (deceleration). The strength of the tousens is applied in the First calculate the properties of the section for a beam of 300º 650: a = 300 £650 = 195 000 mm2 second moment of area, i, is BH3 BH3 I = 300 6503/12 = 6866 Âµm 106 mm4 Section module for the top fiber, ZT, I / X. For a rectangular section 650 mm depth, the baricenter is in the center and this is: zt = 6866 Âµl 106/325 = 21.12Ãƒ 106 mm3 (Some people use the tremula for rectangular sections, ZT = BH2 / 6, which does the same answer). X = h / 2 h 24. Civil Engineering Design (1) Dr. Caprani24 Likewise, ZB = -21.12 Âµl 106 mm3 (signal convention: ZB is always negative as the media For the fiber background is negative). The load applied only in transfer is the own weight, which is (beton density) to (area). Thus: Auto Weight = 25 (0.3 ãƒ 0.65) = 4.88 KN / M The maximum moment due to this load is: transfer moment, mt = 4.88 (12) 2/8 = 87.8 KNM The total load of SLS is this the most applied load, that is: SLS MOMENT, MS = (4.88 + 6) (12) 2/8 = 195.8 KNM The Provision it causes an axial tension of p / a = 2500A 103/195 000 = 12.8 n / mm2: WL2 / 8 LW p 25. Civil Engineering Design (1) Dr. Transfer C. In CAPRANI25, the stress due To the proportion and applies, after the beam is raised, the stress due to the own weight. The moment auto weight in the center generates a higher voltage of: mt / zt = 87.8 106/21.12Ãƒ 106 = 4.2 n / mm2. Therefore, transfer verification in the center is: in SLS, the tensioning has reduced by 20%. The top and bottom tensions due to applied load (MS) are, Â ± 195.8 Âµl 106 /21.12 Âµl, = Â ± 9.3 n / mm2. Therefore, the SLS verification is: 10.2 9.3 -9.3 19,5 0.9 + = Auto Performance Total weight 12,8 12,8 4,2 -4.2 17 , 0 8,6 + = Auto Peso Total Pressure 26. Civil Engineering Drawing (1) Dr. Caprani26 NUMBER EXAMPLE A With eccentricity according to the previous example, but the forces of protective It is p = 1,500 kN at 100 mm below the centroid. An excessric force is equivalent to a force in the centroid plus a moment of force eccentricity to: this is equivalent to: so the distribution of stress due to the protrusion in the transfer It was constituted by 2 components: p / a = 1500A 103/195 000 = 7.7 n / mm2 0.1 M pp pp pp 0.1p 0.1p 7.7 7.7 27. Civil Engineering Design (1) Dr. C. Caprani27 and + PE / Z. In top fiber, this is -. 6 3 1012,21) 100) (101500 (A = -7.1 As the moment is pig, stress on top is tension, this is, the same negative shape tension in fiber inferior of + 7.1 hence the total distribution of stress due to the ps is: hence the transfer verification is: + = dead major load + - -7.1 7.1 0 , 6 14.8 0.6 14.8 4,2 -4.2 4.8 10,6 28. Civil Engineering Design (1) Dr. C. Caprani28 of SLS, Preme -tension has reduced by 20% (both from the PE / Z components are reduced by 20% as p was reduced in the same proportion). The voltage distribution, due to the applied load is as for example 1 . Hence the SLS verification is: + = Performance full load 0.48 11.8 9.3 -9.3 9.8 2.5 29. Civil Engineering Design (1) Dr. C. Caprani29 3. PSC Project Members 3.1 Bases Enter Convention's End of Drift Equations That Allow Project, We maintain a convenion of Rough Signs: â € ¢ Moment: Positive Sag; â € ¢ Ecentricity Prorison : Positive above centroid; Â € â € ¢ Modulus Section: Negative for MEM BER fund; Â € ¢ Stress: positive compression. With said convention, we now have: Thus, the final tensions are numerically given by: + + - + = T PE z B PE ZPA TIBI + - C T MZC B MZ + PA 30. Engineering Project Civil (1) Fiber Dr. Caprani30 Top: C TTT P PE Mazz i = + + Bottom fiber: C BBB P PE Mazz i = + + Note that the means of convention signal that: A â € Terms pa is always positive; Â ¢ â € ¢ The term C H z positive or negative, depending on the fact that it is T B z or Z, and; Â € ¢ â € ¢ The term PE z is negative for T z from T z is positive and and is negative and the term is positive for b z since now both b z and and are negative. These travel signals match the above diagrams, as they should. Which governs the inequalities given to the Convention of Rigid Sign and the Admissible Tensions in the and noting that losses are to be taken into account, tensions are limited as: transfer Top fiber A tension must be greater than the Admissible Traction Stress: TT TT TT TT TT PE MMF AZZ AQUZ \ ª ¥ (1) Bottom fiber Ã ¢ ¬ "The stress must be lower than the compressive stress allowed maximum: 31. Engineering Project Civil (1) Dr. Caprani31 B TC T TC BBF P PE MF AZZ \ ° â € ° â € ° â € œ Â¤ Â¤ â¤ (2) The upper serving fiber The Ã ¢ â € "The stress must be lower than the compressive stress allowed maximum: T SC TTF P PE MF AZZ \ ° â € ° â € ° Â¤ Â¤ Â € ¢> + + + + â € œ â € œ å "å" â € ¢ â € ¢ â € š å¾ å¾ å¾ å¾ Å \ , ¬ "stress should be greater than the minimum stress tensellio allowed: b are bbf p p pe mf Ã¯ ¥ ¥ ¥ Å ¥ >>> + + + + ¥ ¥ ¥ Å "å" Å ~ Å "(4) in these equations should be remembered that numerically, any permitted voltage is a negative amount. Therefore, all permitted tensions should be greater than this tension , that is, ideally a positive number, indicating that the member is in compression in the fiber in consideration. of Same way, all tensions should be lower than the compressive stress allowed. 32. Civil Engineering Project (1) Dr. Caprani32 3.2 Minimum Section Modor Given a piece of paper blank, it is difficult to check tensions. Thus, we use the inequalities that govern us to calculate the minimum section modules for the expected moments. This is the first step in the PSC design process. High fiber The upper fiber tensions should meet the criteria of equations (1) and (3). Thus, from the equation (1): TT TT TT TT TT TT TT PE MF AZZP PE MF AZZ PE MF AZZ PE MMF AZZ PE MF AZZ PE MF AZZ PE MF AZZ PE MF AZZ AZ Â © ± + + ¥ ¥ ¥ ¥ ¥ ¥ ¥ â € ¥ ¥ ¥ ¥ â € ¥ ¥ â € ¥ ¥ â € ¥> + + A ¥ aaaa Ã ¢ Ã ¢ â € ¢ Ã ¢ â € £ ¢ â € ¢ â € ¢ â € ¢ To the £ £ £ | If now add this to equation (3): ST SC TT TTTTTST SC TT TT P PE MP P PE M FF AZZZZMM FF ZZ Âµ Â ± Â ± Â ± Â ± Â ± ct Â ± â € â € â € â € ¢ â € ¢ â € ¢ â € ¢ â € ™2 ¢ â € ¢ â € ¢ â € £ â € £ Ã ¢ å "Å" Å "to â € ¢ â € ¢ â € ¢ â € œ € £ â € œ € € € € ° â € ° â € ° â € ° â € œ â¤ Â¤ Â¤ Â¤ Â¤ Â¤ Â¤ Â¤ Â¤ â¤ Â¤ 1) Dr. Caprani33 inferior fiber The lower fiber tensions must meet equations (2) and (4). Thus, from equation (2): tc BB BB BB P PE MF ABZZP PE MF AZZP PE MF AZZ Â ± Â ± Â ± Â ± + + + Â ° Â¤ Â¤ > Â¾ + + â € ° â € ¢ å "å" å "å" å "å" å "å" £ >>>>>> + + + + Ã ¢ + Ã ¢ â € ¢ ¥ ¥ ¥ ¥ ¥ ¥ ¥ Å ¥ Å "å" å "å" å £ â € ¢ â € £ £ â € £ | Ã ¢ | Adding equation (4) to this: ST TC BBBST ST TC BB P PE MP PE M FF AZZZZZAZAZMM FF ZZ Â ± Â Â ± Â ± Â¤¤¤¤ >>>>>>>>>>>>> Å¾ + â € >> Å¾ ¥ ¥ ¥ â € ¥ ¥ ¥ å "Å" å "ã € £ â € ¢ â € ¢ â € ¢ â € ¢ £Amable S UL Superior ZZ F M and Pania Â € ° â € ° â € ° â € œ Â¤ Â¤ â¤ Â¤ Â¤ Â¤ Â¤ Â¤ Â¤ Â¤ Â¤ Â¤ â¤ Â¤ â € ° â € ° â € ° â € ° â € œExtions superior kerns and inferior (the quantities t za eb za) are constant for constant geometry, and once it is also constant, it can be seen that the cable limits follow OM Let's profile than the flexing moment diagrams in the transfer and service. 51. Civil Engineering Project (1) Dr. Caprani51 Example of problem for the bundle of the previous example, outperform the upper and lower eccentricities, given a 450-kn court. Solution in the previous example, the kerns were found to be 58.33 mm 58.33 mm tb zaza Â «=« = + the ~ â € ¬ ¬ "moments of tongua â € Å €" () () () () () () () 6 6 4.083 10 1 4.083 KNM 4,083 10 0 0 KNM TT T TT ST B ST MZ F = = = = = = = = Â £ - = From here to the lower limit we have: ,,, 4,083 58,33 450 58,33 1.02 450 59.35 450 TT TT TX TXXX ZZ FME APMMM â € ¢ «= Â α« = + = «= Ã, â €52. Civil Engineering Project (1) Dr. Caprani52 and for the top :, ,, 0 58,33 0.8 450 58,33 360 BB St S SXSX ZZ FME APMM Â ¢ «+ + Ã ¢ = + ƒ- = ¢ = = knowing the values of bending moments in positions along the beam, now we can trace the limits of eccentricity: 0 50 100 150 200 250 0.00 2.00 4.00 6.00 10.00 distance Along the bundle (m) DistemoFOffit (mm) centretic low ER higher in this figure the superior and lower eccentricities are very closely in the chromic section. This is because the prestress chosen is very close to the possible minimum of the admissible region. A larger prestrete would give the limits of â € ™ ¬ "Looser. 53. Civil Engineering Project (1) Dr. Caprani53 Debond warning from the eccentricity limits of the previous example that a Cable / Retro-Light Tend profile will not work. However, we know of discussion about the prested factory of protended sections that straight tendons are preferable. Changing the forces of the prestress along the length of the beam, we can find a solution for this problem. From the previous example, the new eccentricity limits are: 0 50 100 150 200 250 0.00 2.00 4.00 6.00 8.00 10.00 10.00 10.00 Distemment along the beam (m) DistemmentFromoffit (mm) Centroid Superior top profile can be seen that an eccentricity of 85 mm below the centretic axis works. Note that it seems that there remains a problem at the ends of the beam. However, the cable force gradually increases in reality due to the transmission zone (ie, the connection between tendon and concrete). Therefore, the tensions will be acceptable â € â € > å¾ = + A A A A A ¢ ¢ Ã¿ å¾ Å Ã ¢ å¾ 67. Civil Engineering Design (1) CAPRANI67 Dr. C. the voltage stress and the £ £ sÃ in the prestressing steel: PT PT PTT PP FP ® F ® AE = EstÃ¡ the transom 2 © sufficient when applied to the concrete to decompress the navel aÃ§o. Provided there is a £ ligaÃ§Ã between the aÃ§o and concrete, mudanÃ§a in the voltage £ aÃ§o in protensÃ £ o Ã © Ã equal concrete in navel aÃ§o. Thus, the voltage at the aÃ§o £ Ã © protendor now Ã®Î¼ + CT PT. This EstÃ¡gio 3 Ã © £ diagram of voltage at the load end. The voltage £ concrete in the navel of aÃ§o, the CPU Œ ±, £ estÃ¡ voltage related to the concrete at the top of the seÃ§Ã £ ¢ by tria similar angles: p DXX CPU CU ® ® ® Ã ¢ Ã ¢ = = = = a ¢ Ã Ã ¢ ½ Ã¿ the mudanÃ§a the voltage on the steel prestressing £ Ã ©, for compatibility, the same as the CPU ®. Final Voltage £ end of the aÃ§o protensÃ £ load at the end © as follows: PU PT = CT CPU Ã®Î¼ Ã®Î¼ this equaÃ§Ã + £ O, © only CPU that does Ã®Î¼ £ â © known. This can be achieved since a depth of neutral axis Ã © found that balances the horizontal forÃ§as. 68. Civil Engineering Design (1) Dr. C. Example CAPRANI68 Problem Determine the best moment capacity of the seÃ§Ã £ shown. The tent £ the aÃ§o has a prestrete transferÃªncia of 1200 kN and Ã¡rea strand A © 1000 mm2. The Module for elÃ¡stico aÃ§o of protensÃ £ â © 195 kN / mm2 and the concrete 45 A © n. The soluÃ§Ã the voltage £ £ £ stall in the original due to the DAR -testamento © Ã ©: () () 3 3 1200 10 0.00615 195 10 1000 PP SAP ® T EN - = A = £ - the voltage £ in the concrete caused by PRA -rolamento initial © ©: () () 2 233 3 3 1 1200 10 2751 1200 10 29.8 10 750 350 350 750 12 0.00040 C T CT EP ® Ã ¢ EAI Å¾Å¾Å¾ = ¢ + Ã ¢ Ã Å Ã¿Ã¿ å¾ å¾ Ã Ã ¢ å¾ å¾ å¾ å¾ å¾ £ Ã = Ã + Ã ¢ Ã ¢ Ã¿Å Ã¿ Ã £ £ Ã Ã Ã Ã © Ã © Ã Ã Ã Ã © © © Ã Ã ½ x = Ã®cu Ã®cpu strain stress / forÃ§a diagram S = 0.9x 0.45FCU AP FC PU 750 650 350 69. Civil Engineering Design Section Engineering Design (1) Insufficity Dr. C. No Caprani69, the concrete strain to the protective level The is: 650 0.0035cpu xx £ £ £, ã £ = aaaa and so the final strain in the conceo Pr ecorção is: 650 0.00655 0.0035PU xx £ £ £ = + AA and the final force in the steel Preme-theforço is: () () 3 6 650 1,000 195 0.00655 0.0035 650 10 195 10 0.00655 0,0035 upp pu pae xxxx £ = â € ¢ â € ¢ A = A + ã â € â € ¢ â € ¢ â € ¢ â € ¢ â € £ £ | Ã, â € ™ a = A + ã, â € ¢ â € ¢ â € ¢ â € ¢ £ | The force in the concrete is: () () () 0.45 45 350 0.9 6379 f C XX = A = in the correct depth for the neutral axis, we will be horizontal equilibrium of forces, UC pf =. That iteratively try to find this value of x: 70. Civil Engineering Design (1) Dr. C. Caprani70 XC F u p Different 350 2232563 1862250 370312,5 250 1594688 2369250 -774563 300 1913625 2073500 -159875 315 2009306 2003083 6222 , 917 314 2002928 2007568 -4640.97 314.4 2005479 2005771 -291,992 Hence the moment capacity is: () () 2005771 650 0.45 0.45 314.4 1,020 knm uuup MP z p dx = = a = AAA = 71. Civil Engineering Design (1) Dr. C. Caprani71 5.2 Fund Shear Final The Shear Project Procedure for PSC is quite different from the common RC. It varies significantly from codigo to the code. However, there is a problem with PSC that can have a significant influence on shear design. This is the vertical component of the protective force that can have a beneath effect I am significant. In addition, the shear capacity depends or does not the section cracked under the moments of flexion to the section. It should be noted that nominal connections are required in PSC members, similar to common reinforced members. IP Bearing i PP Sini 72. Civil Engineering Design (1) Dr. Capacity Caprani72 Shear for Sections Cracked A section is cracked in flexure If the moment is higher than a moment of Design fissuration, 0 m, defined below. Cracking shear capacity, CR V, is empirically give by: 1 0.55 0.1ps The CR CVV Cu PU F MV VBD V BDFF M AA = A + A Â Â Ã é Ã é , Where: M is the moment acting the section; V is the transverse effort that acts in the section; 0 m is the necessary moment to remove 0.8 from the compression voltage to the protective level: 0, 0.8 ceimfe = where: 2, sscegg p pe fai = + ps f is the voltage in the SLS tendon; pu f is the maximum traction force of the tendon; v b is the web cutting width / section; D is the effective depth; CV is the concrete shear creation force: 0.25 0.33 0.79 0.33 100 400 1,25 25 SU CV A FVBDD AAAAAA = ã, ã, At the om to the ivors 73. Civil Engineering Project (1) Dr. Caprani73 Shear Capacity for Section UNCRACKED SECTIONS A is UNCRACKED If the applied moment is less than 0 M. In such section, the main stress of the web is limited to 0.24T CU FF =. Based on the analysis of a Mohra S Circles, the following equation is derived: () 2 0.67 0.67 tt cp p v bh v fff = + + in which: CP f is the tensan Compression due to the proportion in the center of gravity center: S CP P F fa = P V is the vertical component of tension arrest in the section, resisting the cutting applied; And the remaining variables â € â € œ have their previous meaning. 74. Civil Engineering Design (1) Dr. Caprani74 Shear Drawing Drawing Resistance to Shear to a section is: [] UNCRACKED: Cracked: Min, Vvvvv C CO C C C C = = The design of Shear is: One Â ¢ 0.5 C VA Â¤: There are no calls are required; Â € ¢ 0.4cv vv b dÂ â¤ shear are used: 0.87 SV CV YV TVD SFD ¢ = Where: SV A is the link area; v are the spacing of connection; YV F is the characteristic forces of connections; T D represents the depth for the most distant, normal or pristine action, from the compression face. 75. Civil Engineering Design (1) Dr. Caprani75 Example Problem The Y beam, as shown, has a width of the 200 mm rib and a depth of 1000 mm. Its area is 310 £ 103 mm2 and its second moment of area is 36 to 109 mm4. The Construction Action Area is 1803 mm2, which is forces 1750 n / mm2 and is emphasized for 60% of its forces in service in excentricity 290 mm. The concrete is grade 50. Check the section for a shear of 400 kn and associated moment of 800 KNM. Note that the tendon is inclined by 3 «¡Ã¡ in the section considered. Solution First determine the following: () () () 1803 0.6 1750 1893 KNT PS PA F = = Ãƒ- = 3 2 3 1893 10 6.1 n / mm 310 10 s CP PFA Ãƒ- = = = = ÃƒÂ Â © 0.24 0.24 50 1.7 n / mmt cu ff = = = shear capacity not created: () () () () 2 2 0.67 0.8 0,67 200 1.7 1.7 0.8 1.7 6.1 1893S3 448.2 99.1 547.3 KN C CP PV BH FFF V = + + = ÃƒÂ ¢ © + Ãƒ- + + = + = 76. Civil Engineering Project (1) Dr. Caprani76 for cracked shear capacity, we have the following entries: 0.6 PU FF = () () () 2, 233 3 9 2 1893 10 2901893 10 310 10 36 10 10 10.52 n / mm SSCEGG P PE F ai = + Ãƒ-Ãƒ-- = + ãƒ-- = () 0,8 0.8 36 10 0.8 10.52 290 1046 KNM CE IM FE = ÃƒÂ Â © -> Ã ¢ = = Å "Å" ¢ Ã ô = 0.33 0.25 0.33 0.33 0.25 0.33 2 0.79 100 400 1.25 25 0.79 100 1803 400 50 1.25 200 790 790 25 0.78 n / mm s cu cv fvbdd Ã ¢ ¾ >>>>>> Å¾ >>>>>> Å¾Å¾Å¾ = Ã ¢ å "£ â € ¢ Â € £ ¢ £ ¢ € £ å ¾ ¾ ¾ ~ £ £ >>>> å¾ >>>>>>> Å¾Å¾ = = Å "Å" â € ";â € fâ € fâ € fâ € œ3 £ Å¾ ¾ Å¾ Å Å¾ = from here () () () () () 3 1 0.55 0.1 1046 1 0.55 0.6 0.78 2 00 790 400 10 0.1200 790 50 800 605.4 111.7 605.4 KN PS OR CVV Cu F MV Vbd v bdff m Ã ¢> ¢ = ¥ ¥ å "¥ å" å "å" å "å" å "å" å "Ã ¢ å" Å¸ Â € ¢ â € ¢ £ ¢ £ ¥ ¥ â € ¥ â € ¥ â € ¥ œness Â¤ and thus the resistance of the design shear is 547.3 kn, which is larger than the 400 kN applied. Therefore, use nominal links. Links.