# COMPARATIVE ANALYSIS BETWEEN TWO STANDARDS TCVN 5574:2018 AND TCVN 5574:2012

## *Part 4: Evaluation method and analysis of results*

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**ABSTRACT**

*In the new standard TCVN 5574:2018, replacing TCVN 5574:2012, there are significant changes in structure, materials and calculation methods compared with the old version TCVN 5574:2012. The standard TCVN 5574-18 has approached EC2 and ACI standards to increase international integration, and it has also changed the perspective of computational modeling, converted from stress model to strain model. This article analyzes and compares two standards to highlight new points, helping designers to distinguish easily and conveniently apply TCVN 5574:2018 in practice. To achieve the goal, the authors organize into five main contents as follows: Part 1: Some general notes; Part 2: Comparison of materials in two quality standards; Part 3: Comparison of calculation methods in two quality standards; Part 4: Evaluation method and analysis of results.*

**Keyword:** *TCVN 5574:2018, TCVN 5574:2012, Reinforced concrete, Standard, Strain model*

## 1. INTRODUCTION

The design standards of reinforced concrete structures of countries around the world are often updated and changed regularly. The period for updating and modifying is usually about every 3 years and renewal about every 10 years. The current standard for the design of concrete and reinforced concrete structures TCVN 5574:2018 [2] took effect from December 10, 2018, and replaces the old version of TCVN 5574:2012 [1]. TCVN 5574:2012 [1] was published in 2012. It has been moved from TCXDVN 356:2005 [3] and had been retained in its entirety, only renamed. Furthermore, TCXDVN 356:2005 is translated from the Russian standard SNIP 2.03.01-84 which was made more than 30 years ago. Thus, we had used too old standards compared with the progress of science and technology in the world. This problem had caused many inadequacies in the design process. Standard [1] stipulates the use of steels (such as CI, C-II, C-III...) according to the old standards before, so it is not linked with the new standards of Vietnam. as standard on current reinforcement steel, or prestressed steel (pre-stressed): TCVN 1651:2008 [4], TCVN 6284:1997 [5, 6, 7], TCVN 6288:1997 [8].

Therefore, to update new information in the field of design of concrete and reinforced concrete structures, standard [1] has been replaced by TCVN 5574:2018 [2]. This standard has been written mainly based on the Russian standard SP 63.13330.2012. With this approach, it will not cause much confusion in teaching and designing practice. In this new standard [2], it has many new points that deserve attention: the calculation perspective is changed from the stress model to the strain model (accepting the flat section assumption), calculating Puncture math and other new points are presented below.

## 2. MAIN CONTENT

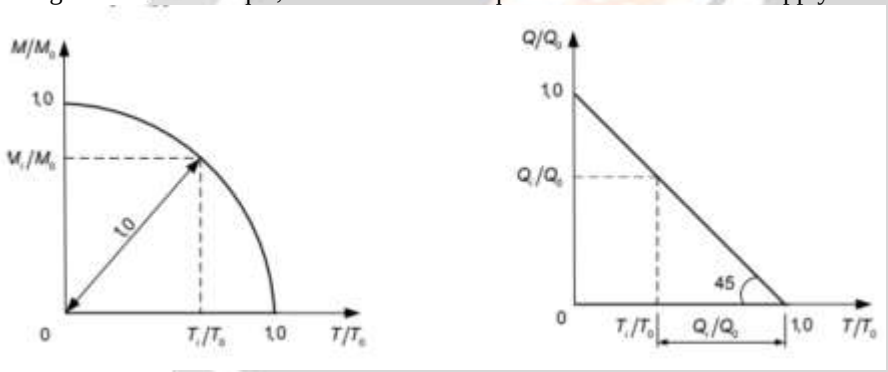
For durability calculation: Calculate according to the internal force limit including the plastic working of concrete and reinforcement in a conventional way. Here, when calculating the perpendicular section, the formula for determining the limit height of the compressive concrete area has been adjusted. The formula for calculating the critical force according to Euler is also rewritten in a more general way, consistent with the representation of many standards around the world.

For calculation according to crack formation, crack expansion, and deformation: Use general principles of structural mechanics and material strength for reinforced concrete structures. Then, to evaluate the crack width, a more physical computational model should be used. It is based on the reciprocal displacement between the reinforcement and the concrete over the length between the cracks. This allows us not to use the empirical approach to perpendicular crack width calculations and strain calculations that were still used in the old standard.

For the calculation subject to the shear force: Still based on the limited internal force using the inclined section model as in [1], but it has been adjusted the calculation formulas and the calculation process to calculate simpler math.

For local compression calculation: Still based on limited internal force and adjusted calculation formulas.

For torsional calculation: Still using the spatial section model as in [1], but it uses interaction diagrams between bending moment and torque, shear force and torque and it is also easier to apply than the old standard [1].




a) Interactive diagram M /$M_0$ and T/ $T_0$. b) Interactive diagram Q/$Q_0$ and T/ $T_0$

***Figure 1***. Interactive diagrams when calculating torsion.

Calculation of puncture: Using the model is applied in the standards of other countries and it takes into account the influence of the acting moment in two directions that in [1] did not mention.

Calculation of the length of reinforcement: The length of the overlap is also determined according to the new formula:

$$L_{lap} = \alpha L_{0,an} \frac{A_{s,cal}}{A_{s,ef}}$$

In which: $A_{s,cal}$ , $A_{s,ef}$ is the cross-sectional area of the reinforcement according to the calculation and according to reality, respectively. α = 1.0 and 0.75 for reinforcing bars (without prestressing) in tension and compression, respectively.

## 3. CONCLUSIONS

The design standard of concrete and reinforced concrete structures TCVN 5574-18 has gradually approached the EC2 standard and a little approach to ACI ($\varepsilon_b$ = 0.003). It has changed the view of computational modeling and has moved from the stress model to the strain model. This model is recommended to be used as a priority for calculation according to limit states (first and second) for members subjected to bending moments and longitudinal forces. It

still allows úing the limited internal force method for members with simple cross-sectional shapes such as rectangle, T, and I.
TCVN 5574-18 has added: how to calculate steel for floors and walls; The breakdown calculation allows to take into account the influence of bending moments in both directions, which is different from the previous standard which has not been taken into account. The calculation of local compression is still the same as the previous model, but the calculation formula is adjusted.; The torsion calculation still uses a spatial model according to the limited internal force method, but uses interaction diagrams when the bending moment and the torque, as well as the shear force and the torque, are applied simultaneously; Calculation of the inclined section without including the oblique reinforcement (very true to reality). The shear calculation still uses the inclined section model, but it has adjusted the calculation formula to make the calculation simpler; Calculation of semi-assembled structures will gradually become popular when the construction industry is rapidly industrialized.

TCVN 5574-12 has not been detailed, even omitted, so it was confusing to apply. As it did not state the establishment of calculation equations for members with any symmetrical cross-section, the establishment of calculation equations for other common cross-sections. At that time, the nonlinear deformation model was complicated and difficult to apply in practice, especially in oblique bending, oblique eccentric compression. It has not established the calculation method of tension and compression members eccentrically T, I, box. It also did not establish how to calculate $A_s$, when there are As, Asp in tension concrete. It did not set l0 for industrial columns, cranes, trusses, and domes. It also ignored the compression force before calculating the inclined section. It also did not consider how to prevent punctures by nails, by load-bearing reinforcement; did not mention the calculation of the break (reinforcing the auxiliary beam on the main

## 4. ACKNOWLEDGEMENT

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