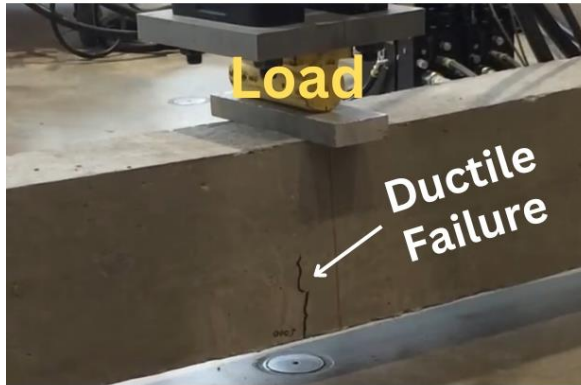


# Why do we prefer **Under-Reinforced Beams** over **Balanced & Over-Reinforced Beams**?



**Under-Reinforced Beam**



**Over-Reinforced Beam**

December 29, 2022 Muyeen Mubarak

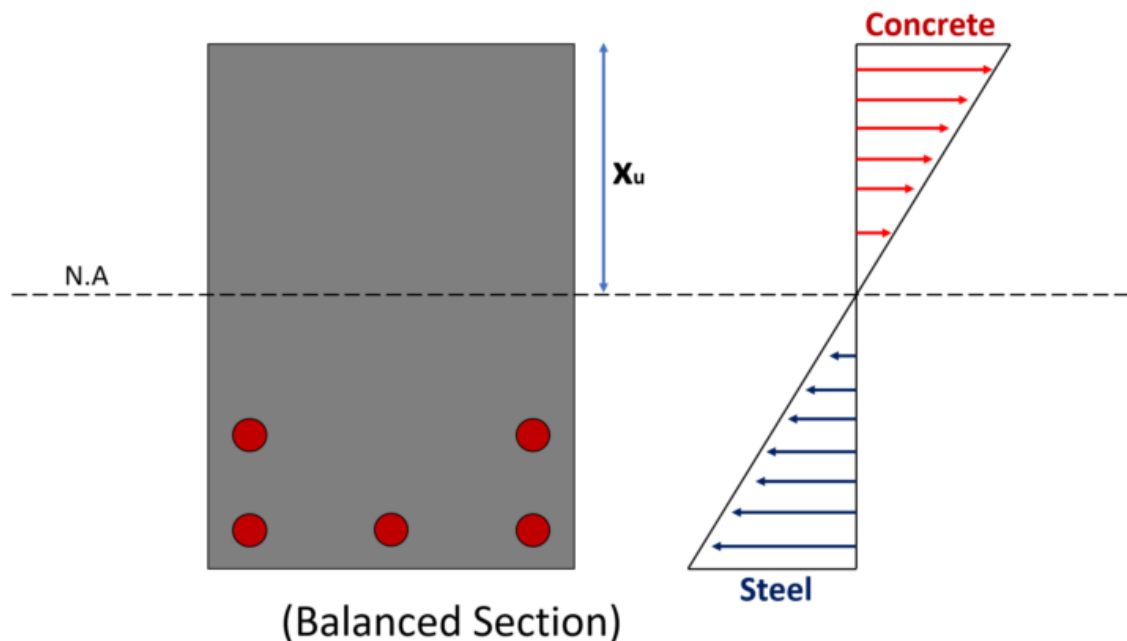
<https://civiltutorofficial.com/why-do-we-prefer-under-reinforced-sections-over-balanced-or-over-reinforced-sections/>

When it comes to designing RCC beams, there are several options to consider when it comes to the amount of reinforcement used. Generally, we have 3 types of sections. i.e.

1. Balanced Section.
2. Under Reinforced Section & ,
3. Over Reinforced Section.

In this article, I'm going to explain to you all the three sections in detail and at the end, we will discuss, **Why do we prefer Under-Reinforced sections over Balanced or Over-Reinforced sections?**

## **1. Balanced Section:**

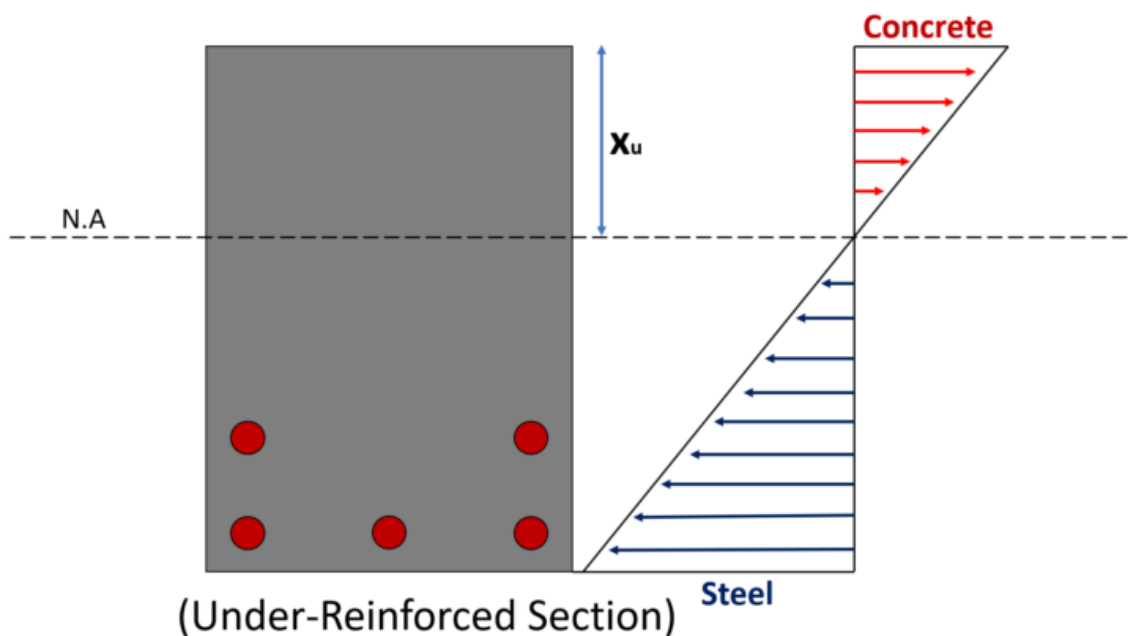


If we talk about the Balanced section, this type of section is designed in such a way that, if we apply load on the member, the permissible strength of both the concrete and steel is achieved at the same time. In addition to that, both the materials will fail at the same time and such a failure is known as “**Balanced failure**”.

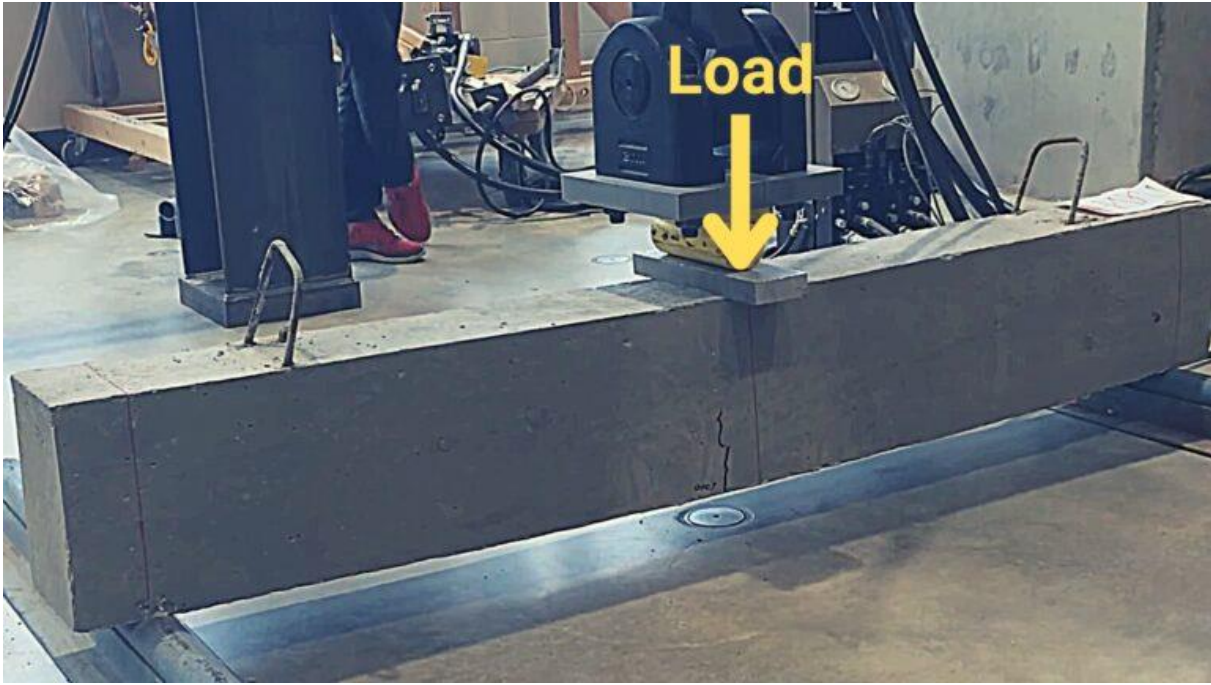


Balanced Failure

## 2. Under Reinforced Section:

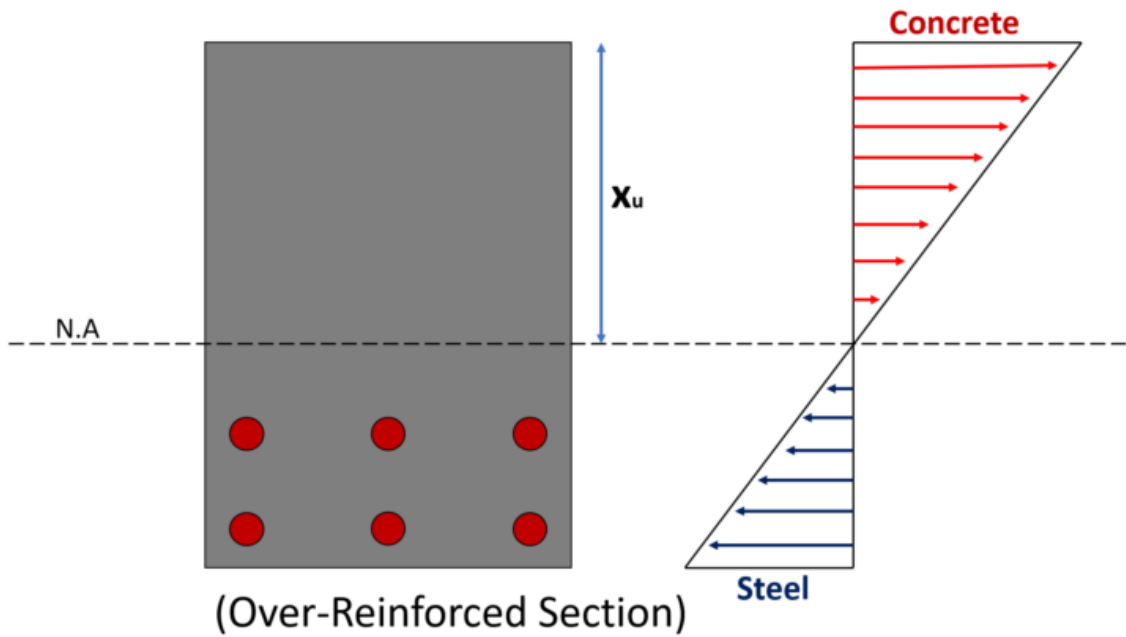


The under reinforced section is designed in such a way that, the permissible strength of steel is less as compared to concrete so that, after the application of load on this particular member, the failure of steel takes place prior to the failure of concrete. Such type of failure is known as **Ductile Failure** or **Under Reinforced Failure**.



Ductile Failure

### 3. Over Reinforced Section:



Brittle Failure

In the case of an Over Reinforced section, the permissible strength of steel is greater as compared to concrete. After the application of load on such member, the failure of concrete will occur prior to the failure of steel. Such type of failure is known as **Brittle Failure** or **Over Reinforced Failure**.

Now coming to the main question – **Which one is the most commonly used section?**

The most preferred and commonly used section is the Under Reinforced section. The reason being that, this is considered as the safest and the economical section among all the 3 sections.

Now the question arises, **what makes it the safest section?**

As we know, for an under reinforced section the failure of steel takes place prior to the failure of concrete and since the steel is ductile in nature, it will deflect downwards on the application of load and due to the elongation of steel, the bottom fiber of the beam will develop cracks. Thus, giving enough warning to the users of the structure to evacuate before the failure of concrete.

However, in the case of Balanced & the Over Reinforced sections, the failure of concrete occurs either at the same time or prior to the failure of steel and since the concrete is brittle in nature, it will collapse suddenly without giving any warning to the users of the structure thus, resulting in loss of life and property.

**What makes it the economical section?**

Under reinforced sections are also preferred from the economical point of view. As we know, the cost of steel is more as compared to that of concrete and since the permissible strength of steel in Under Reinforced section is less as compared to the Balanced and the Over Reinforced sections which means less quantity of steel in Under Reinforced section. Thus, adding to the economy of the structure.