

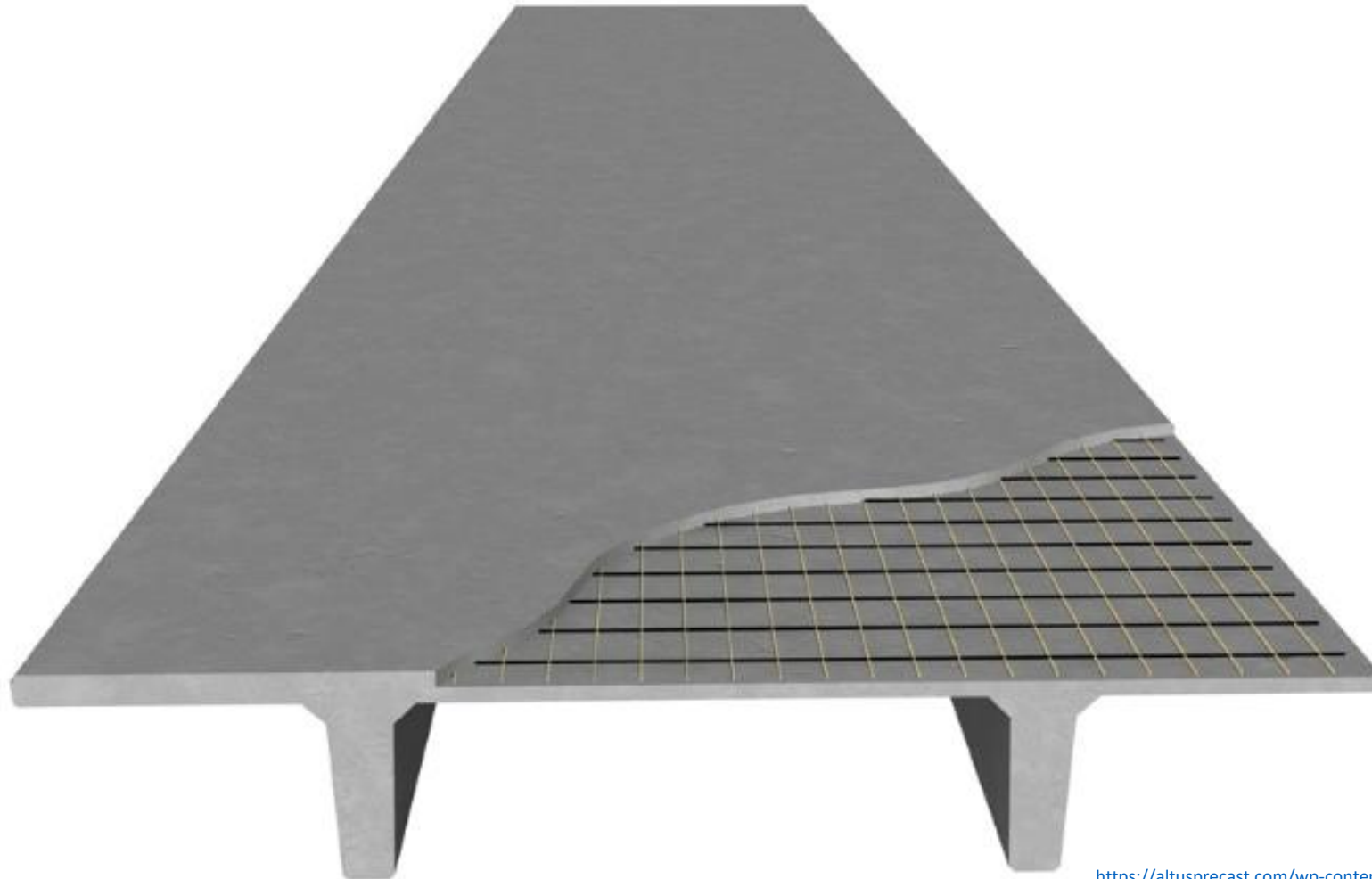
# Double Tee's



HORIZON TOWERS CONDO ASSOCIATION

# What is a Double Tee?

---



# **Double Tee Description:**

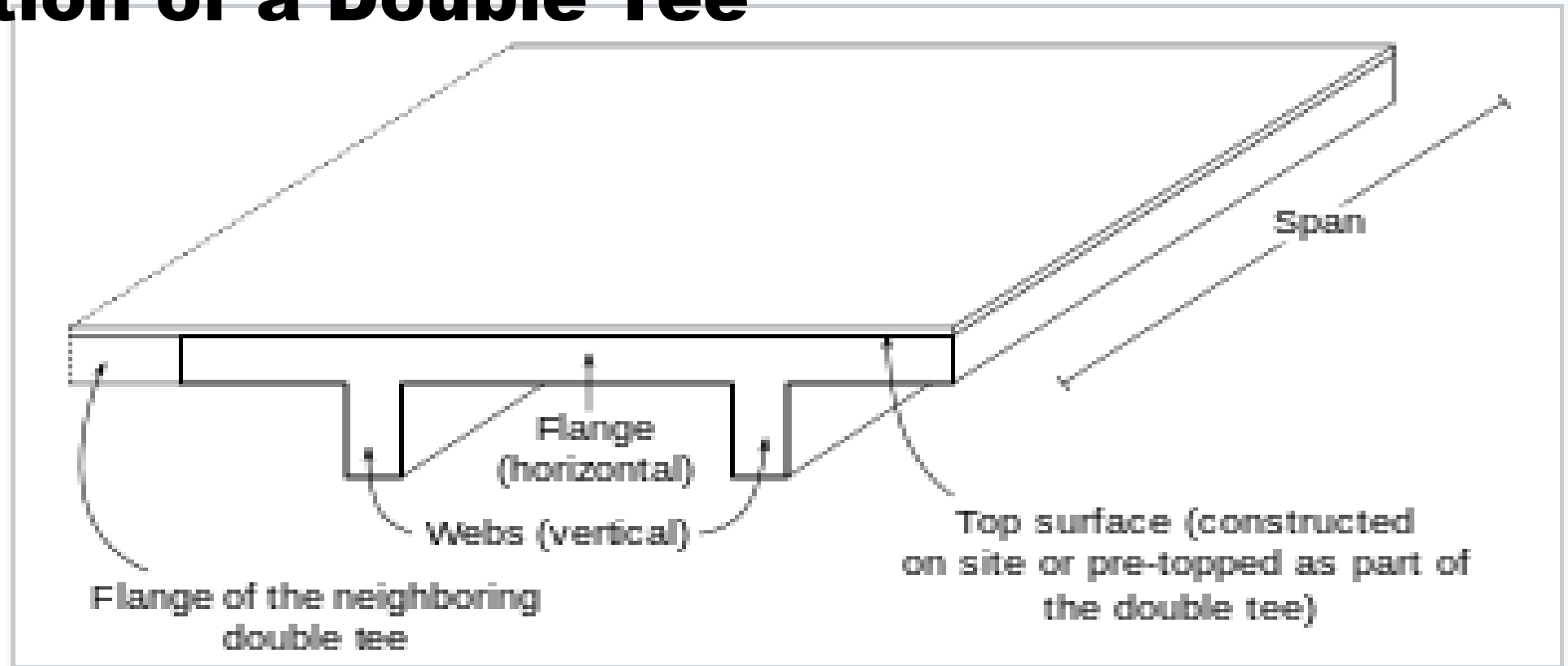
- A precast, prestressed double tee resembles two side-by-side capital letter Ts.
- Cables in tension are cast in a Double Tee mold.
- After the concrete cures, the cable ends are cut leaving the stems in compression adds to the (beam) web strength.
- This compression shortens the lower section of Double Tee. This results is upward camber, Which counteracts dead loads, live loads and creep deflection.
- Once the Double Tees are installed in a building, engineered connections of the Double Tees are welded and if appropriate, treated for water resistance.
- After the building's Double Tees are installed, a topping generally of concrete is applied to obtain the smooth surface you walk on every day.
- Double Tees that are exposed to rain and the elements, (i.e. the area in front of H-T) are often protected by an elastomeric waterproofing membrane to avoid water penetration.

**CONCRETE IS STRONG IN COMPRESSION AND WEAK IN TENSION.**

**BY INCLUDING STEEL IN THE DESIGN OF A DOUBLE TEE, STRENGTH IN BOTH TENSION AND COMPRESSION IS OBTAINED.**

**STEEL WITHIN THE TEE RUSTS WHEN EXPOSED TO MOISTURE, THE RUST EXPANDS AND CRACKS THE SURROUNDING CONCRETE, FACILITATING FURTHER AND MORE RAPID DETERIORATION.**

# Illustration of a Double Tee



A **double tee** or **double-T** beam is a load-bearing structure that resembles two [T-beams](#) connected to each other side by side. The strong bond of the flange (horizontal section) and the two webs (vertical members, also known as stems) creates a structure that is capable of withstanding high loads while having a long span. The typical sizes of double tees are up to 15 feet (4.6 m) for flange width, up to 5 feet (1.5 m) for web depth, and up to 80 feet (24 m) or more for span length. Double tees are pre-manufactured from [prestressed concrete](#) which allows construction time to be shortened.

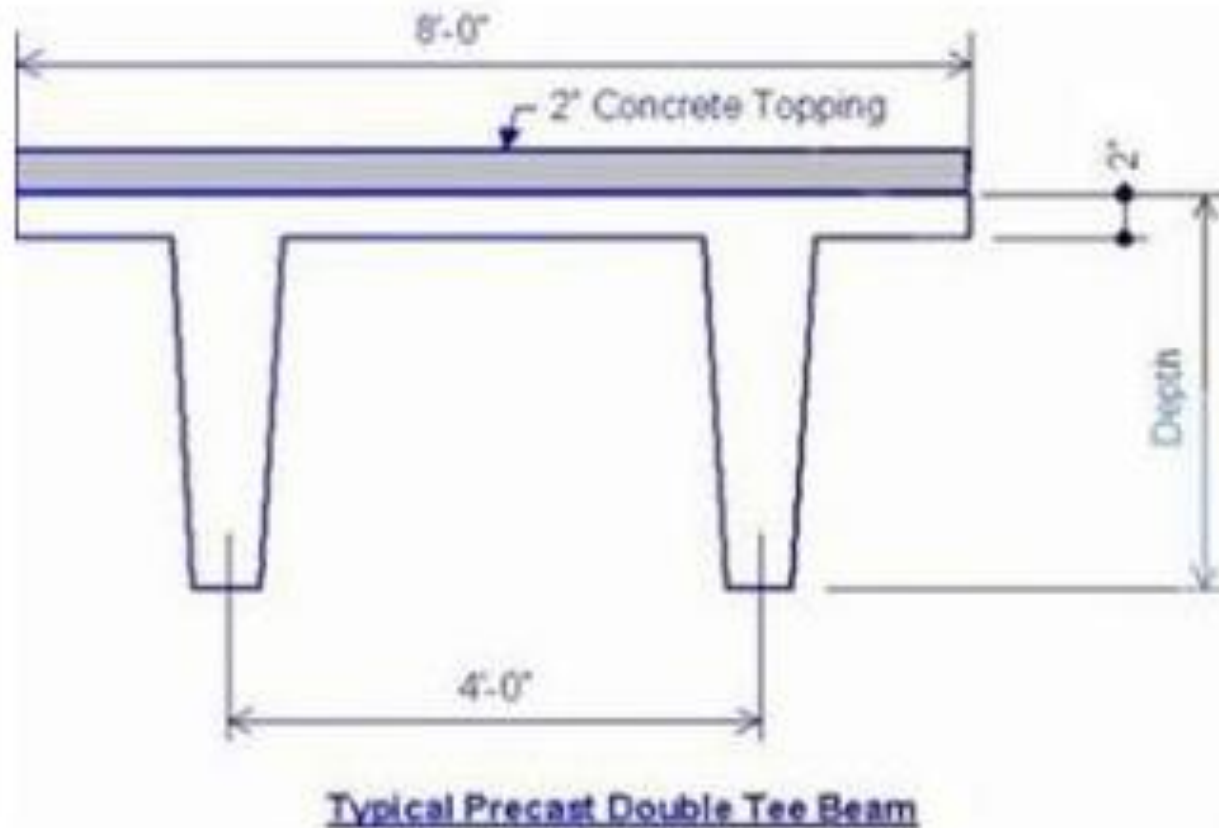
# End View of Double Tee



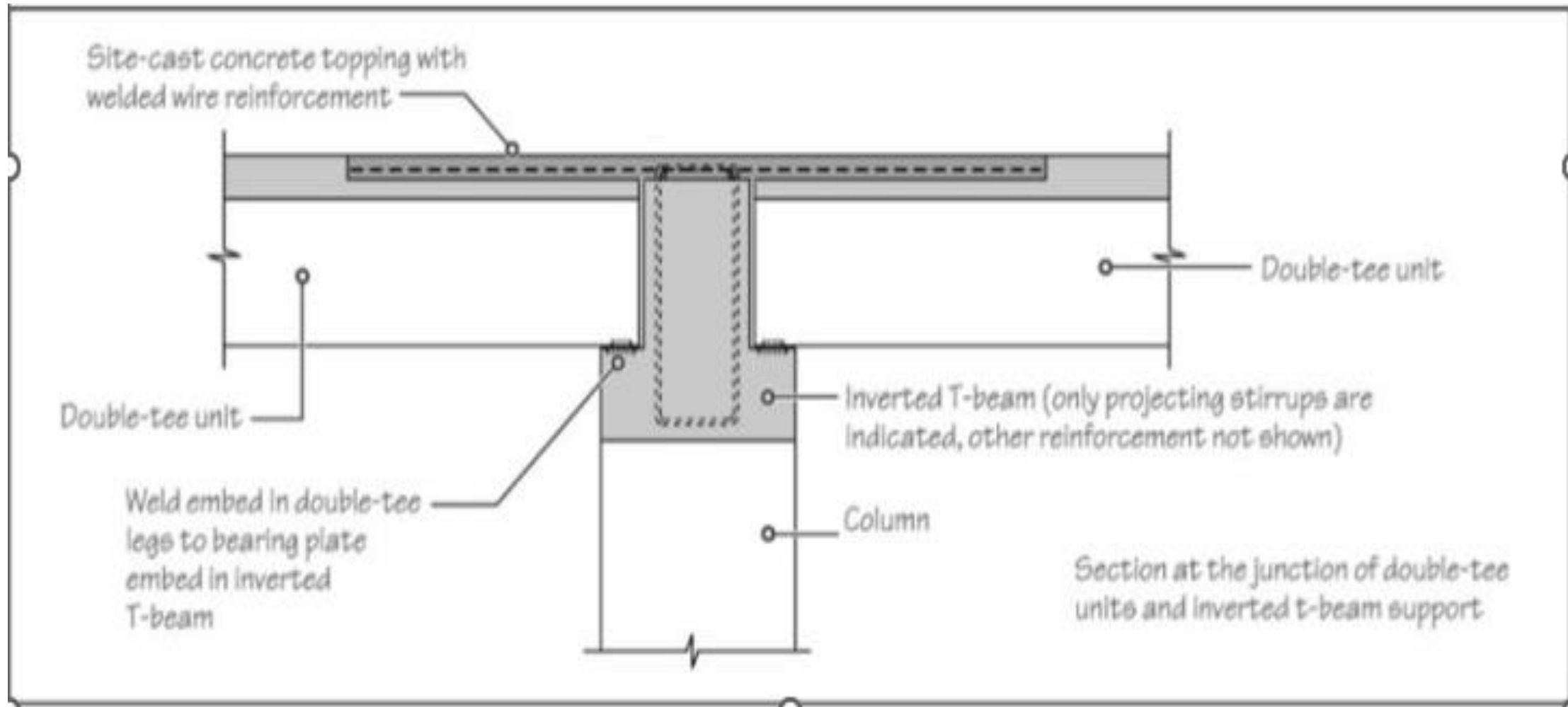
# How and Why are Double Tees Capped or Topped?

- To protect and preserve the underlying structure.

(Note: Topping is a continuous surface and bridges adjacent Double Tees.)



# Example of Two Double Tees Meeting and Resting on Supporting Wall





# **Double Tee's Resilience**

- **Double Tees are amazingly strong and resilient, until compromised,**
- **Usually by the effect of water and chemicals water may contain.**
- **Continual monitoring and maintenance is required;**  
**and, if ignored,**
- **The results are EXPENSIVE repairs.**

# Double Tee Parking Structure



[https://www.bing.com/images/search?view=detailV2&ccid=Xn9mvRof&id=2FFCA70993A627B97EBBEE17E7B4133EFB8B4828&thid=OIP.Xn9mvRoft1uooD-H2bqMiQAAAA&mediaurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fR.5e7f66bd1a1fb75ba8a03f87d9ba8c89%3frik%3dKEil%252bz4TtOcX7g%26riu%3dhttp%253a%252f%252fwww.oscoconstructiongroup.com%252fResources%252fImages%252fimages\\_concrete%252fdoubletee\\_pic1.jpg%26ehk%3dpaM70m%252bU13aWliArog1uTj0MtUqUG9wXkSpz3gxqjLo%253d%26risl%3d%26pid%3dImgRaw%26r%3d0&expw=185&q=double+tee+in+parking+garage&simid=608016349971498495&FORM=IRPRST&ck=69BA95AF635C8A33F09C4C6EEC7BE84E&selectedIndex=53](https://www.bing.com/images/search?view=detailV2&ccid=Xn9mvRof&id=2FFCA70993A627B97EBBEE17E7B4133EFB8B4828&thid=OIP.Xn9mvRoft1uooD-H2bqMiQAAAA&mediaurl=https%3a%2f%2fth.bing.com%2fth%2fid%2fR.5e7f66bd1a1fb75ba8a03f87d9ba8c89%3frik%3dKEil%252bz4TtOcX7g%26riu%3dhttp%253a%252f%252fwww.oscoconstructiongroup.com%252fResources%252fImages%252fimages_concrete%252fdoubletee_pic1.jpg%26ehk%3dpaM70m%252bU13aWliArog1uTj0MtUqUG9wXkSpz3gxqjLo%253d%26risl%3d%26pid%3dImgRaw%26r%3d0&expw=185&q=double+tee+in+parking+garage&simid=608016349971498495&FORM=IRPRST&ck=69BA95AF635C8A33F09C4C6EEC7BE84E&selectedIndex=53)

# Example of a Double Tee End Repair



# **How do you Protect a Double Tee from Deterioration and Damage?**

**Maintain a SEALED topping with appropriate WATERPROOFING.**

**Prevent water from seeping under the Top Cap!!**

**If water intrusion is visible, locate the source of the water path and seal.**

**Once water wets a Double Tee, the water will find it's a way to the steel inside.**

**The steel can rust and swell and typically BREAKS the surrounding concrete.**

**Broken Concrete allows water to more easily penetrate a component and may increase the rate of deterioration.**

**A degraded Double Tee or other component may be considered to have "Failed" without exhibiting catastrophic failure.**

# Horizon Towers Garage Pictures (P3)



# Horizon Towers Garage Pictures (P3)





# Horizon Towers Garage Pictures (P3)



# Horizon Tower Garage Pictures



**P3**



**P1**



# **Analysis of Knott Lab's Proposal to Evaluate Horizon Towers Structural Issues**

**I recommend that the Horizon Towers Board and Owners choose Knott Lab's Tier 2 proposal vs. the Tier 1 proposal because of the immediate need to correct outdoor surface sealant and water barrier leakages, that cause continuing interior structural damage.**

**The Tier 1 proposal primarily focuses on interior structural issues and does not survey entrance level deficiencies.**

**For an additional fraction of the Tier 1 cost, Tier 2 offers the same services as Tier 1 and includes an outdoor entrance level study upon which action can be taken to interrupt water damage, ---in the SHORT TERM**

**As long as water intrusion continues, structure damage also continues, and owners' costs to repair increase non-linearly over time.**

# **Suggested Sequence of Board Evaluation of Tier 1 or Tier 2**

- **The Board (and Owners) meet with Knott Labs to gain an understanding of Knott's proposed Contract Terms and Scope of Work, -- beyond the limited information available in the Knott's Proposal.**
- **The Board conducts due diligence of Knott's proposed contract.**
- **The Knott contract is submitted to our attorney for review.**
- **If the Board's due diligence and our attorney's evaluation are positive, the Board further considers Knott's proposal leading to it's acceptance.**

# **Review**

- **A review of Knott's web site indicates they have resources to provide Horizon Towers with a quality and comprehensive analysis of structural issues.**
- **The value to our Association of having analyses of parking level structural deterioration and identification of sources of water leakage from outdoor entrance area into the garage, is significant. Both engineering studies must be performed before repairs to correct our building deterioration can begin.**
- **I look forward to the Board proceeding with the restoration of our wonderful building in a professional, timely, and economic way, and in a manner that best serves Association Members and Residents.**

**Andy Hatfield**

**Director**

From: **Stanley Stoll** <[SStoll@knottlab.com](mailto:SStoll@knottlab.com)>

Date: Wed, May 17, 2023 at 11:46 AM

Subject: RE: Horizon Towers Proposal

To: Sam Henning <[shenning@knottlab.com](mailto:shenning@knottlab.com)>, Horizon Towers <[horizontowers81506@gmail.com](mailto:horizontowers81506@gmail.com)>

Hi Charles,

I agree with what Sam has provided here but did want to add a couple of things. Regarding the invoice, if it would help, we could roll those costs into the future work if that would be helpful. Then you would have that as part of a board approved scope for your system. Maybe that is helpful?

Then second, please understand that these are pretty serious issues that you are dealing with. In the post surfside collapse environment, everyone is paying more attention to the indicators of structural deterioration. You certainly have structural deterioration. What we do not know yet, is how bad it is. So, whether it is us or another engineer, please make sure that someone is evaluating this further. As professional engineers, we are ethically bound to protect the life and safety of the public and there is a lot of pressure on engineers to escalate situations to building officials when necessary to enforce safety. So, we just want to know that the situation is being addressed.

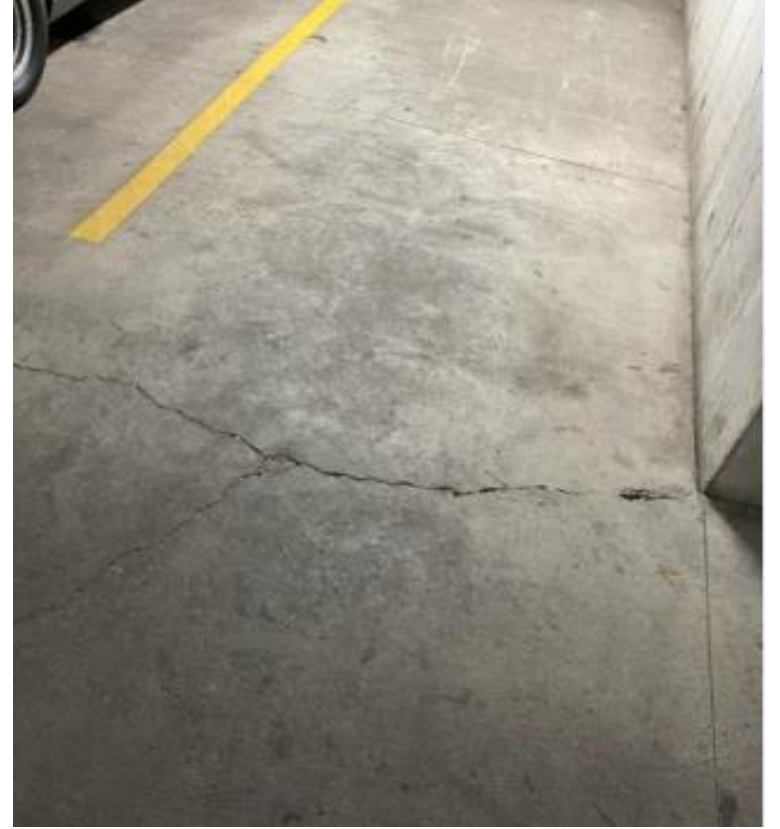
I also want you to know that this is a problem that has had some Band-Aids applied in the past that are not properly addressing the issue. As the building continues to experience moisture intrusion, that concrete will continue to deteriorate until this becomes a really big problem. We just do not know when that will be. If you need assistance in conveying the severity of the situation to your board, Sam or I are happy to do so. We just want to make sure this is getting addressed and you are able to get the resources allocated that are necessary to correct the issues. Those repairs are not going to be cheap, but they will be required at some point in the near future.

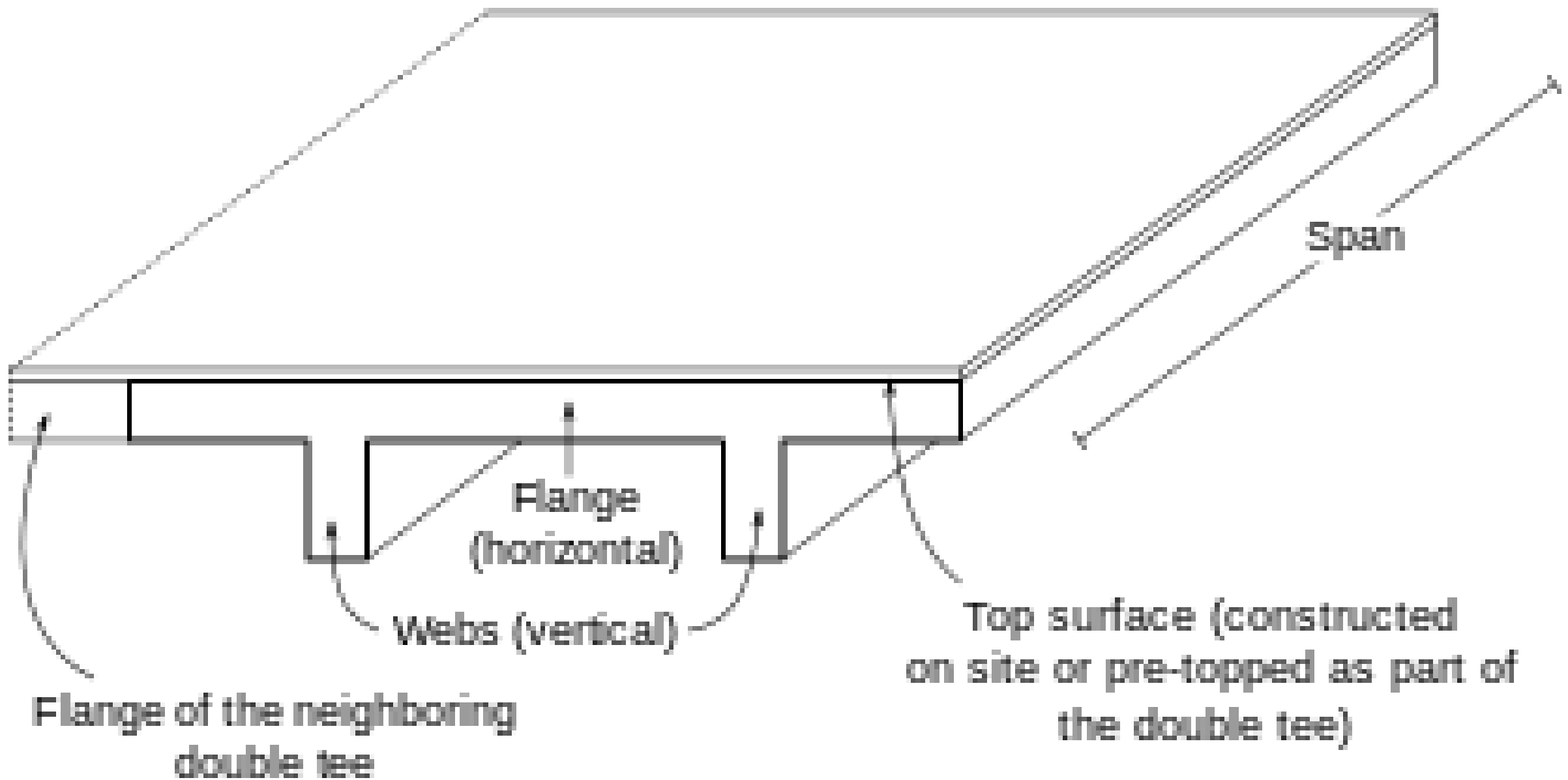
Thanks, let me know if you have any questions.

- Then second, please understand that these are pretty serious issues that you are dealing with. In the post surfside collapse environment, everyone is paying more attention to the indicators of structural deterioration. You certainly have structural deterioration. What we do not know yet, is how bad it is. So, whether it is us or another engineer, please make sure that someone is evaluating this further. As professional engineers, we are ethically bound to protect the life and safety of the public and there is a lot of pressure on engineers to escalate situations to building officials when necessary to enforce safety. So, we just want to know that the situation is being addressed

- Yes, this is essentially “Tier I” without the analysis of the foundation movement. I would recommend we still look into the high-level grading/drainage issues causing the distress to the T-beams as these go hand-in-glove. The moisture issues need to be identified and repaired as to prevent further damage to any repairs as well. During this phase, we would also need to look at the concrete beam openings which support the T-beams in the parking garage. Some of these exhibited cracking during our inspection and likely require some form of strengthening or repairs as well. Removing the foundation movement from this scope, “Tier 1 A” scope would be approximately \$12,000-\$14,000. Please keep in mind this is for the analysis and conceptual repair recommendations for ballpark contractor pricing. Stamped engineered repair plans can be provided at an additional fee dependent on repair scope.

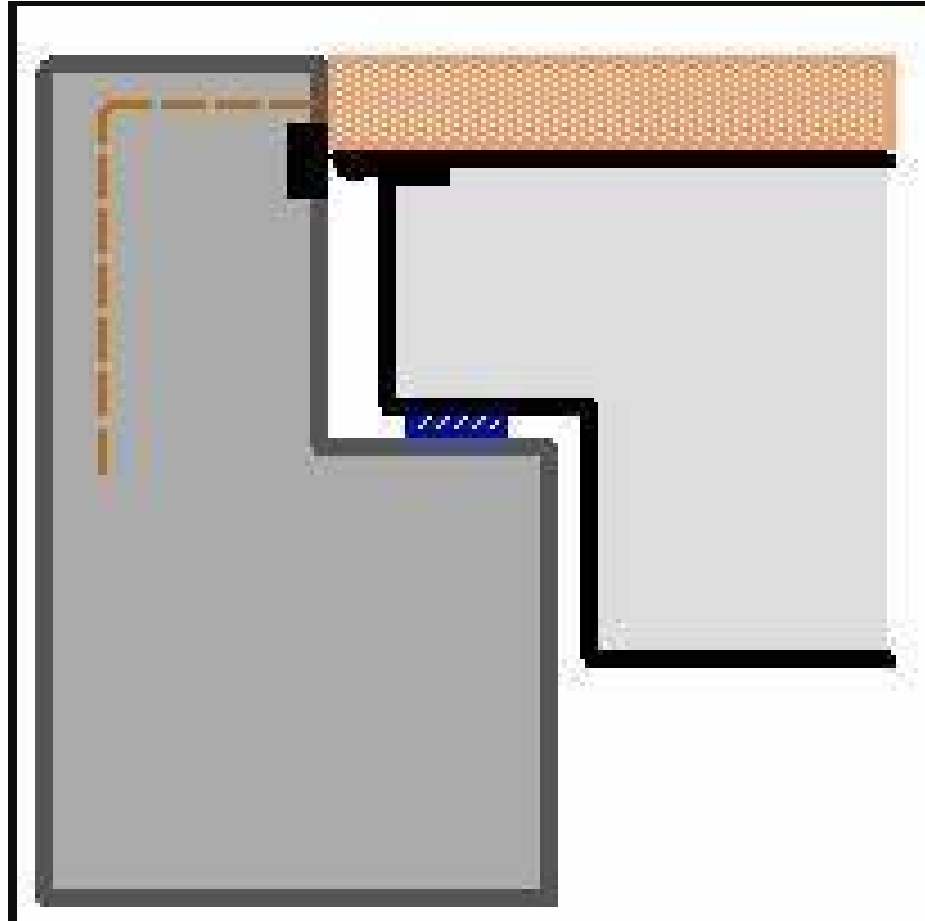
# Horizon Towers Garage Pictures (P1)



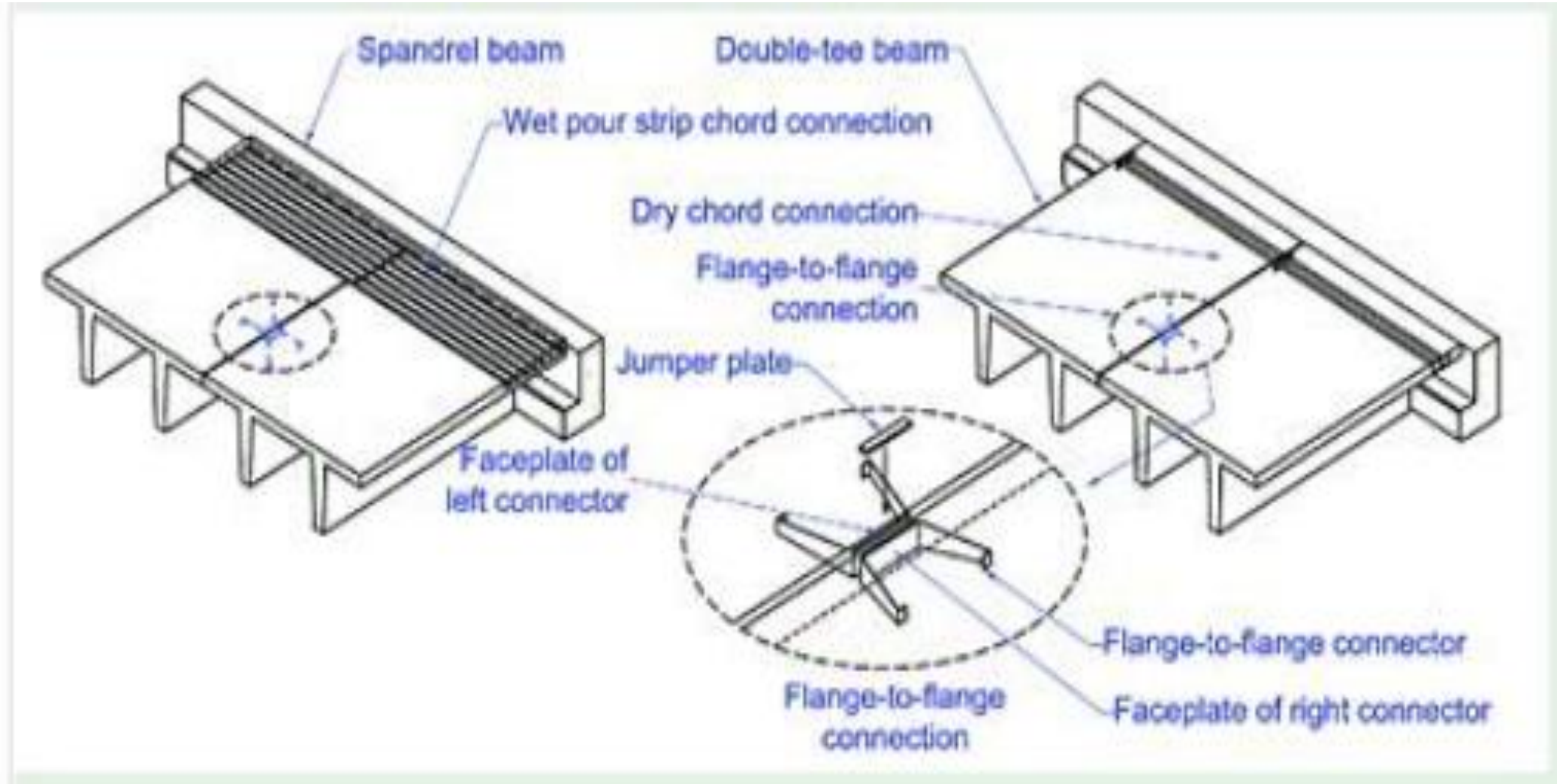




# Example of Supported Double Tee



# Inside a Double Tee



# Strength of Double Tee (Load Test in Colorado)



**Double Tees are a design marvel that combine strength and durability. When steel and concrete are combined together in a unique “Double Tee” configuration, it creates superior load bearing capacities.**



# **Illustration of Exposed Tensioning Cable Strands for Evaluation/Repair**

