

# **Creative applications of wood in transit structures**

Kreative Anwendungen von Holztragwerken für  
Transitbauten

De l'usage créatif des systèmes constructifs bois à  
destination des bâtiments de transit

Duane Palibroda  
Fast + Epp  
CA-Vancouver





# Creative applications of wood in transit structures

## 1. Historical use of timber in transit structures

Wood has traditionally been one of the most common building materials due to its widespread abundance and ease of workability. Examples of early timber structures includes the following:



Figure 1: 1000 year old bridge – China



Figure 2: 19<sup>th</sup> century train tressle in North America

## 2. Changes during the industrial revolution

The industrial revolution introduced new materials including wrought iron, cast iron, structural steel and reinforced concrete, which slowly began displaced wood as the building material of choice. Examples of these new types of structures are shown below:

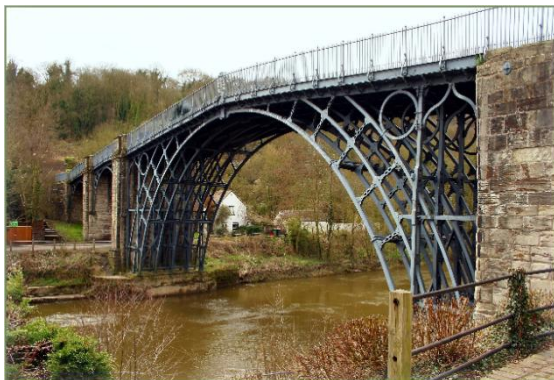


Figure 3: Iron Bridge – United Kingdom – 1779



Figure 4: Liverpool St Station – London, UK – 1874

Modern transit stations continued to follow the path of steel and concrete, as shown in these recent examples:



Figure 5: Waterloo Station – London, England



Figure 6: Lyon Train Station – Lyon, France

### 3. Wood makes a comeback

Wood was re-introduced in transit structures in British Columbia, Canada in 2001. However, before wood was permitted it had to overcome a number of constraints.

#### 3.1. Constraints

- **Durability:** Wood had to be protected from direct exposure to rain, snow and ultra-violet rays.
- **Fire resistance:** Wood needed to comply with the “heavy timber” requirements of the building code, by providing an inherent 45 minute fire resistance rating due to the protective “charring” effect of mass timber.
- **Protection from vandalism:** Wood needed to be located out of pedestrians reach.

#### 3.2. Other inherent wood advantages

- Wood has a warm visual aesthetic.
- Wood speaks directly to the sustainability aspects of design.
- Wood can easily be used in conjunction with other building materials such as steel or concrete to create a “hybrid” structure, taking advantage of the inherent strengths of each specific material.

### 4. Projects

Fast + Epp has completed a number of transit structures over the past 16 years, utilizing wood in a variety of ways. The following projects serve as examples of how wood can be successfully incorporate in new and innovative ways.

#### 4.1. Rupert Station – Vancouver, British Columbia

- **Feature:** Simple first application of wood in a Vancouver transit station.
- **System:** Cantilevered glulam – steel hybrid frames.



Figure 7: Rupert Station



Figure 8: View from platform



## 4.2. Gilmore Station – Burnaby, British Columbia

- Feature: First application of prefabricated wood - steel panels.
- System: Hybrid Timberstrandwood -steel kingpost& cable panels.



Figure 9: Gilmore Station



Figure 10: View from platform



Figure 11: Shop fabrication



Figure 12: Site installation

## 4.3. Brentwood Station – Burnaby, British Columbia

- Feature: First application of wood – steel arch frames.
- System: Solid nail-laminated(38mmx89mm individual laminations)wood roof covering a double curvature roof form, all supported by hybrid glue-laminated beam – steel curved arches.



Figure 13: Brentwood Station

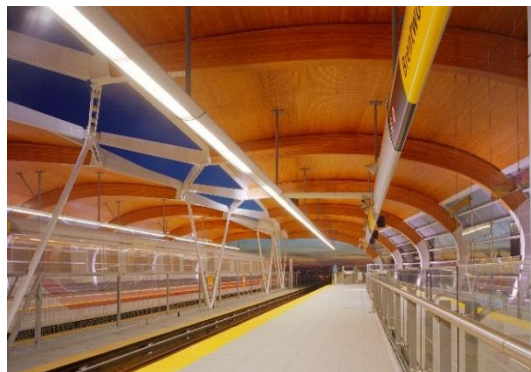


Figure 14: View from platform

#### 4.4. Canada Line – Vancouver & Richmond, British Columbia

- Feature: First application of prefabricated wood-steel hybrid panels incorporating pre-placed lighting and services conduits within the panels.
- System: Pre-fabricated hybrid nail-laminated wood – steel hybrid frames. Similar pre-fabricated panels were incorporated into 4 stations for a unified design approach, with the panels individually shaped/configured to respond to the unique aspects at 3 of the 4 stations.



Figure 15: Canada Line Station



Figure 16: View from platform



Figure 17: Shop fabrication



Figure 18: Site installation

#### 4.5. Evergreen Line – Coquitlam, British Columbia

- Feature: First application of pre-engineered glue-laminated timber panels to form a simple, yet expressive, solid mass timber roof.
- System: Glue-laminated solid wood panels spanning up to 10m without intermediate supports and simply fastened to wide flange beam below with self-drilling screws.



Figure 19: Moody Station



Figure 20: Interior view during construction



#### 4.6. UBC Transit Shelter – University of British Columbia

- Feature: Expressive floating timber lattice roof structure, geometrically formed by repetitive pentagonal shapes.
- System: Short glue-laminated pieces fastened together with concealed steel plates and dowels, ultimately forming a rigid plate roof structure which is minimally supported by 4 slender steel columns.



Figure 21: UBC transit shelter



Figure 22: Close up view of roof structure

#### 4.7. Queensway Transit Exchange – Kelowna, British Columbia

- Feature: Expressive 80m long mass timber bus shelter, providing shelter to the main bus terminus in the city centre.
- System: Continuously curving glue-laminated beams supporting glue-laminated mass timber roof panels.



Figure 23: Overall photo



Figure 24: Construction photo

## 5. Summary

After a period of underutilization, wood has found its way back into the building dialog. Once again, wood has demonstrated that it can be a viable first option for any building type, if properly considered and incorporated. The transit project examples presented demonstrate that it is possible to create elegant, expressive and efficient structures, while at the same time being practical and economical.

Wood has indeed made a comeback!