Engineered wood comprises multiple ply layers that are glued together rather than a monolithic solid piece of hardwood. The inner core comprises either a hardwood or soft plywood type material e.g. spruce, MDF (Medium Density Fibre), HDF (High Density Fibre), OBS (Oriented Strand Board), etc which incorporates a tongue and groove jointing system. The top thicker hardwood layer is glued on the top surface of the core and is available in almost any hardwood species. Generally the top layer hardwood is produced by a sliced cut. The thickness of engineered floor strips can be from 8 mm to 20 mm.

To create an engineered hardwood, the multiple ply layers are stacked one on top of the other with the grain of adjacent layers oriented perpendicular to one other. Once the desired thickness is achieved, the boards are then cut into the specified board width. By doing this, the engineered hardwood becomes less susceptible to the effects of moisture and temperature change and dimensionally stable, because wood expands and contracts in the width of the grain direction.
8.1 DIFFERENCE BETWEEN LAMINATE, SOLID HARDWOOD AND ENGINEERED HARDWOOD FLOORS

**Laminate flooring** often looks like wood but it is not. It is made of melamine-infused paper glued to a wood chip composite. The prefinished top layer is a photographic layer that should appear identical to the product it replicates, be it wood, vinyl, tile, etc. The product is generally about 10 mm thick and is a floating installation with tongue and groove locking system.

**Solid Hardwood** is produced from solid natural wood species. The primary advantage of the system is good sanding and refinishing capabilities. The product typically is more pleasing aesthetically as they have natural look.

**Engineered wood** is not of full solid wood but created from multiple layers of veneer and lumber boned together with an adhesive. The top layer is genuine hardwood and the engineered components underneath make the flooring more stable. The flooring is available in many wood types and colors and generally comes with prefinished form.

8.2 FEATURES IN ENGINEERED WOOD FLOOR

a. **Dimensional stability**
Wood is a hygroscopic material. Its moisture compensation adapts to the humidity of its environment. This means that wood constantly adjust to its surrounding climate e.g. room temperature and room humidity, by absorbing and releasing moisture. Engineered hardwood flooring could withstand twisting to a certain extent as it is constructed using multiple ply planks. In addition to the top layer hardwood, engineered wood flooring typically has few more core layers at the bottom. The core layers may be plywood, high density fiberboard or others. The layers are placed alternating lengthwise and crosswise grain and this makes the strip dimensionally stable.

b. **No grinding and varnishing**
Engineered wood flooring is prefinished, often with durable finishes including UV-cured polyurethane and aluminum oxide for extra wearability. Using a prefinished floor means there is much less mess during construction and it is quicker to install. Often, the process of sanding and varnishing are time consuming and can affect other trades in construction. Apart from using less site labour and shorten the waiting period between processes, there will be reduction of toxic fumes and dust associated with sanding and varnishing operations. The pre-finished coats are applied by a mechanical system in a controlled factory environment, leading to a smooth and uniform finish surface.

c. **Speedy installation**
Due to the tongue & groove fit and better board dimensions, the installation can be done in an efficient manner. Installation can be done directly on a leveled concrete surface/screed using adhesives or a mechanical interlocking floating system. However it is important that the sub-floor must be level. This is to avoid unevenness on the pre-finished timber floor surface. As curing time and several sanding and varnishing operations are eliminated, this helps to save considerable time in construction, particularly in large scale projects.
The table below shows the number of steps involved in the installation process of traditional solid floor and engineered wood floor.

<table>
<thead>
<tr>
<th>Sequence of solid timber floor installation</th>
<th>Sequence of pre-finished engineered wood floor installation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Apply adhesive.</td>
<td>• Apply adhesive or mechanical Interlocking floating method.</td>
</tr>
<tr>
<td>STEP 1</td>
<td></td>
</tr>
<tr>
<td>• Installation with tongue &amp; groove.</td>
<td>• Installation with tongue &amp; groove, and completion.</td>
</tr>
<tr>
<td>STEP 2</td>
<td></td>
</tr>
<tr>
<td>• Core sanding (after 14 days Curing).</td>
<td></td>
</tr>
<tr>
<td>STEP 3</td>
<td></td>
</tr>
<tr>
<td>• 2nd Grinding.</td>
<td></td>
</tr>
<tr>
<td>STEP 4</td>
<td></td>
</tr>
</tbody>
</table>
Sequence of solid timber floor installation

- Apply filler.

Sequence of pre-finished engineered wood floor installation

- Curing and fine sanding.

- Apply varnish and completion.

Fig. 8.5 – Sequence of installation of solid wood and engineered wood flooring.
8.3. TYPICAL QUALITY ISSUES IN TIMBER FLOORING

a. Open Joint
The most frequent issue posed by timber floors in the tropics is open joints. The predominant cause is that wood is sensitive to variation in humidity and temperature and consequently susceptible to deformation. Other reasons include dimensional variation of the timber strip, unskilled installation, moisture level of the material and substrate, etc. Use of small size timber strips is also a factor as it requires more number of pieces to be joined together to construct a floor. The increased joints are more prone to expansion and contraction in a solid timber floor.

Fig. 8.6 – Open joint in timber floor is the most common issue in the tropics.

b. Nail-hole mark
Nail-down is required when laying timber strips to avoid movement and to secure tight joints in between the strips, especially where the installation is directly on the screed. These nails are removed only after the day of installation. Frequently, the nail holes are patched with timber putty during the first sanding and varnishing stage. It is also not uncommon that improper fillings or discoloration of filling materials affect the aesthetics of the flooring.

Fig. 8.7 – Nail-hole marks and patch-up often undermine the aesthetics of flooring.

c. Unevenness due to over sanding
Apart from undulation in the sub-surface, poor control of sanding on a single spot by unskilled work during the grinding process is another root cause for unevenness in the timber floor surface.

Fig. 8.8 – Poor control in the sanding process may also lead to unevenness in the finished surface.
d. Inconsistency in varnishing
The uniformity of on-site varnish depends on many factors like skill level of the worker, surface condition of the floor and the surrounding environment. In mass production, i.e. for large scale projects, it may not be possible to ensure all workmen possess the same level of skill. As a result, the quality outcome is likely to be inconsistent.

Fig. 8.9 - Consistency of varnishing is likely to vary in manual application.

8.4 CONSIDERATIONS IN SELECTING THE TOP LAYER HARDWOOD FOR ENGINEERED FLOORING
The rigidity of engineered wood floor depends mainly on the top layer of the hardwood veneer. The top layer of hardwood can withstand wearing and dents depending on its Janka hardness rating. The higher the rating, the harder is the species of wood. It also indicates the effort required in sawing the wood. The following are some of the most popular hardwood species used in flooring along with their respective hardness ratings according to the Janka hardness rating.

Other than the selection of top layer hardwood, the choice of core layers and adhesive system is also equally important. For example, if the intended area is prone to moisture, the core material should be HDF board which has better moisture resistant property. Silicone based adhesive system generally performs better than water based glue particularly in terms of bonding and shrinkage. Also, it can bridge over small undulations in the screed to achieve a better level surface.

Fig. 8.10 - Janka hardness index for popular hardwood species.
8.5 LIMITATIONS IN ENGINEERED WOOD FLOOR

The top layer in engineered wood flooring is only about 3 to 6 mm thick hardwood, and can be fine sanded for revitalization of surface coat, but not to level the surface. Unlike solid hardwood, deep scratches and dents in engineered wood cannot be ground out by a machine without affecting the integrity of the flooring. Engineered wood floors come in a wide variety of domestic and exotic hardwood species and some brands have a very thin wear layer, that can only be re-coated and cannot be sanded and refinished again once they get worn. However replacement can be done for critically damaged strips by removing and changing the affected strips. Like any other type of wood flooring, engineered wood floor can also be damaged by excessive moisture and adverse weather. Consequently, it is not recommended that the flooring be installed in wet areas like baths or kitchens.