

STAGE 2 DESIGN AND TECHNOLOGY - MATERIAL PRODUCTS
Assessment Type 1: Skills and Application Tasks

Materials Application

Maximum 800 words

Description of assessment

Investigate and analyse the properties of two or more materials or components that may be suitable for use in the creation of your major product.

1. Begin by considering the **critical properties required** of materials used in your final product (e.g. hardness, durability, malleability, rigidibility, machinability, or others).
2. **Devise methods** in which you **test materials** to determine their suitability (e.g. research, tests, experiments).
3. **Investigate** a number of possible options for your choice of materials. Identify their **properties**. Select two that you think may be most suitable for your product.
4. Investigate these two materials to a greater depth using the methods you identified in Step 2.
5. **Summarise and evaluate** the results of your experimentation with a recommendation for use in your major product.

Assignment

Introduction

For my year 12 Furniture Construction course I have decided to design and produce a Queen Size bed. I wish to use materials that will provide my project with the following properties and qualities:

- Strength to hold two grown people
- hard wood to limit dents
- rustic look

Planning
Purposeful testing and refined modification and validation of ideas or procedures.

I have designed 3 experiments to test materials for these properties. I will record the results, examine them and make a conclusion with reasoning of my choice of materials.

Investigating
Clear, comprehensive, and well-considered identification of a need, problem, or challenge conducting at least two tests.

Materials

The materials I am interested in using are pinus radiata (pine) and recycled timber for my Queen bed.

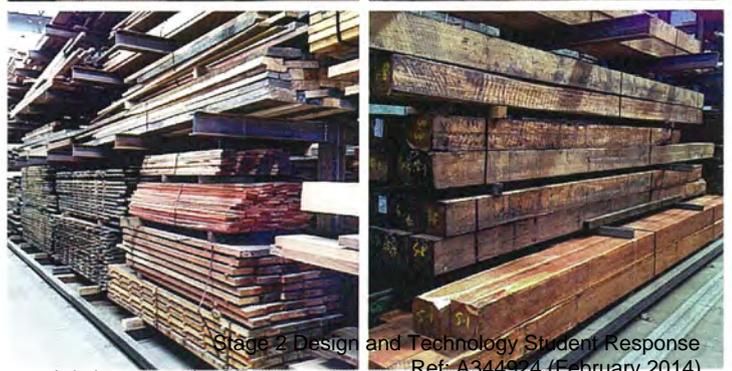
Pinus radiata is adaptable to most soils but ideally it prefers well-drained high rainfall areas. Pine trees were originally native to Oregon USA and were introduced into South Australia in the 1850's. Australia has approximately 1million ha of softwood plantations established. This wood is readily available at our school and the most commonly used due to its cheap price. I also like the different patterns in the wood and as pines is light in colour the dark patterns stand out beautifully.



Investigating
In-depth investigation into product material options and focused and thorough critical analysis for product use.

www.timbox.com.au/products.html

Recycled timber is a mixture of different varieties of aged used wood. The wood comes from a variety of places; decking, railway tracks, old buildings etc. it can be bought at local recycle yards. I thought this material would suit my design requirements of the rustic effect. Using old woods would give it a more country feel although this isn't as convenient as I would need to go source it myself. It is also relatively cheap to buy compared to new timber and is usually good quality.



Experiment 1- Strength

To test the property of **strength** I have completed a strength test.

Aim/Purpose

The aim of the strength test is to see how much weight a piece of thin wood will hold until it breaks.

Materials

- 1 piece of veneered particle board (PB), veneered MDF, pine, meranti and jarrah cut 700mm long 17mm x 8mm
- 2 benches
- 2 clamps
- 1 bucket
- 1 set of scales
- Weights

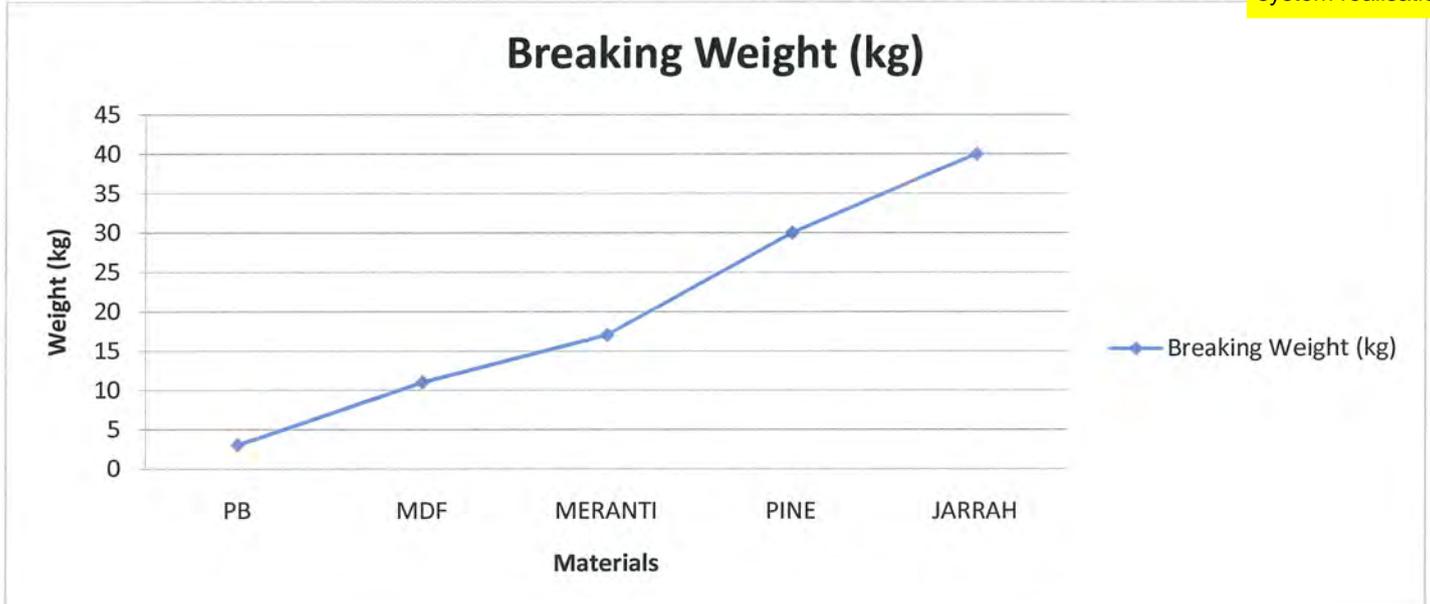
Planning
Purposeful testing resulting in the collection of quantitative data.

Method

- Measure the centre of each piece of wood.
- Set up the benches at 580mm apart.
- Clamp one end of one piece of wood onto a bench and place a bucket in the middle of the wood.
- Clamp the other end of the wood to the other bench.
- Keep placing weights into the bucket until the piece of wood breaks.
- Place the bucket holding the weights onto the scales and record the weight.
- Repeat this for each piece of wood.

Producing
Accomplished and resourceful development of solutions to technical problems that may arise during product or system realisation.

Strength Test



| Material | Breaking Weight (kg) |
|--------------|----------------------|
| Veneered PB | 3 |
| Veneered MDF | 11 |
| MERANTI | 17 |
| PINE | 30 |
| JARRAH | 40 |

Photos



Figure 1.1
Bucket in the middle of the wood



Figure 1.2
Bucket holding bricks to weigh down the wood



Figure 1.3
Broken wood

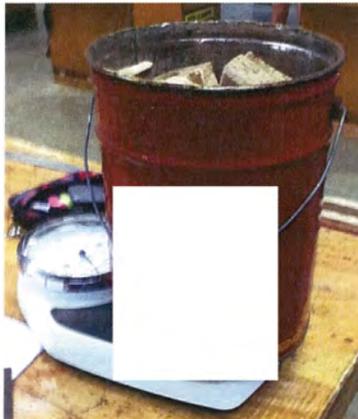


Figure 1.4
Weighing the bucket after the wood has broken



Figure 1.5
All the broken pieces of wood

Summary of Results

The jarrah held the most weights and the particle board broke the easiest with only 3kg see graph above.

Evaluating
Refined and well-considered reflection on materials, ideas, and procedures, with sophisticated recommendations.

Experiment 2- Hardness

To test the property of **hardness** I have completed a hardness test.

Aim/Purpose

The aim of the hardness test is to see the effect of dropping a pointed object onto the surface of different types of wood. This test is taken from the Rockwell test and made to work for my wood test.

Materials

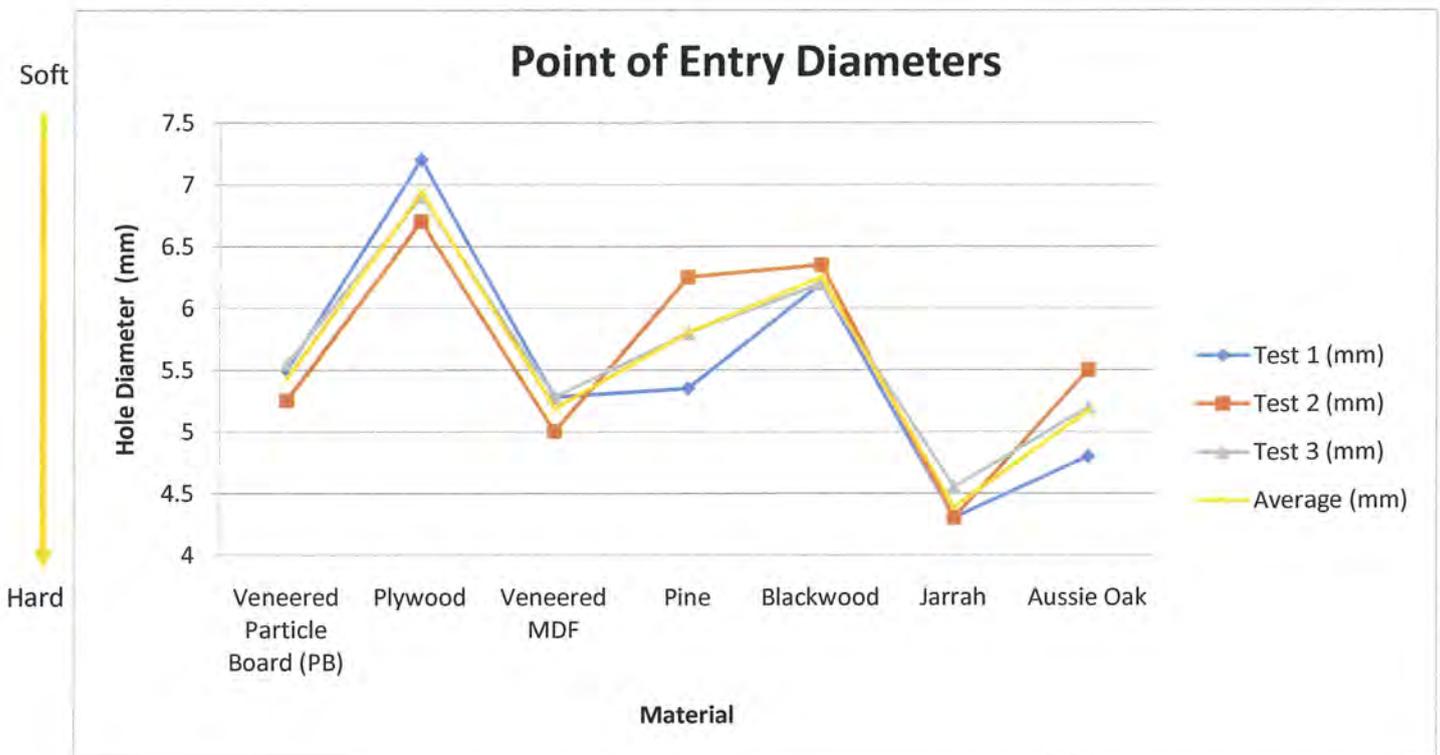
- 4 pieces of veneered Particle Board (PB), Plywood, veneered MDF, Pine, Blackwood, jarrah and Aussie Oak
- Retort stand
- Metal clip
- PVC pipe
- Measuring gauge/Vernier Callipers
- Heavy metal nail punch
- Bench

Method

- Using the retort stand use the metal clip to adjust the PVC vertically at the desired height
- Place one piece of the wood at the bottom of the PVC pipe
- Hold the nail punch pointy end down in the hole at the top of the tube, release when ready
- Measure the entry point of the nail punch using the callipers
- Complete this test 3 times with the same piece of wood, slide the wood around if necessary
- Repeat this test with each piece of wood

Planning
Purposeful testing
resulting in the
collection of
quantitative data.

Hardness Test



| Material | Veneered Particle Board (PB) | Plywood | Veneered MDF | Pine | Blackwood | Jarrah | Aussie Oak |
|--------------|------------------------------|---------|--------------|------|-----------|--------|------------|
| Test 1 (mm) | 5.5 | 7.2 | 5.28 | 5.35 | 6.2 | 4.3 | 4.8 |
| Test 2 (mm) | 5.25 | 6.7 | 5 | 6.25 | 6.35 | 4.3 | 5.5 |
| Test 3 (mm) | 5.55 | 6.9 | 5.28 | 5.8 | 6.2 | 4.55 | 5.2 |
| Average (mm) | 5.433 | 6.933 | 5.187 | 5.8 | 6.25 | 4.383 | 5.167 |



Figure 1.6
Set up of experiment and weight getting dropped

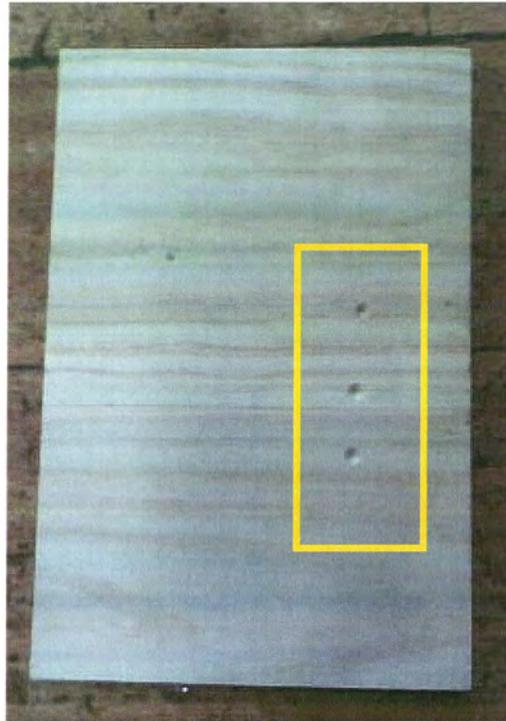


Figure 1.7
Holes made by the weight

Summary of Results

Jarrah again is clearly the hardest followed by Aussie Oak. The manufactured boards seem to be the weaker wood which is not ideal for my bed.

Evaluating
Refined and well-considered reflection on materials, ideas, and procedures, with sophisticated recommendations.

Experiment 3- Finishes

To test for which finishing look to choose I completed a **finishing** test.

Aim/Purpose

The aim of this test is to see which **finish** will suit my end product and give my bed a rustic effect.

Materials

- 4 pieces of 70mm x 19mm pine
- Pine, Jarrah, Golden Oak and Walnut stain
- Paint Brush

Planning
Purposeful testing
resulting in the
collection of
qualitative data.

Method

- Using a paint brush stain 1 piece of wood one of the 4 stains
- Repeat this for all stains
- Leave until they are dry

Finish test



Pine



Golden Oak



Jarrah



Walnut



Figure 1.8
4 different finishes

Summary of Results

I think the Jarrah looks the best but I like the natural patterns the pine finish allows to come through.

Conclusions

From the strength test Jarrah showed incredible strength for such a thin piece of wood. The pine piece was the second strongest which would suit my project well because it doesn't have to be as strong as the Jarrah. Again the Jarrah proved the hardness in all the hardness tests. Jarrah is very strong wood but it would make my project too heavy so pine is the next suitable wood for my project.

The finish test helps me decide which finish would suit my wood. I like the Jarrah finish but I think the natural clear Pine finish brings out the patterns of the wood the best and that is ideal for my bed head.. If I was to use the Jarrah finish I would need to ensure all dents and scratches were sanded back and clear of any imperfections.

Evaluating
Refined and well-considered reflection on materials, ideas, and procedures, with sophisticated recommendations.

References

- "Radiata Pine (Pinus Radiata)." *Radiata Pine (Pinus Radiata)*. Department of Environment and Primary Industry, n.d. Web. 25 Aug. 2013. <http://vro.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/weeds_shrubs_radiata_pine>.
- "Characteristics of Pine Trees." *GardenGuides*. N.p., n.d. Web. 25 Aug. 2013. <<http://www.gardenguides.com/94334-characteristics-pine-trees.html>>.
- "About Australia's Plantation Timber Supply." *About Australia's Plantation Timber Supply*. N.p., n.d. Web. 25 Aug. 2013. <http://rainforestinfo.org.au/good_wood/about_oz.htm>.
- "Recycled Timber." *Shiver Me Timbers*. N.p., n.d. Web. 25 Aug. 2013. <<http://www.shivermetimbers.com.au/recycled-timber.html>>.
- "Rockwell Testing." *Rockwell Hardness Testing*. N.p., 2011. Web. 28 Aug. 2013. <<http://www.wilson-hardness.com/resources/testmethods/rockwelltesting.aspx>>.

Additional Comments

Clear and relevant images are used to document the procedure. These images do not identify the school or student. Appropriate references provide evidence of depth of investigation.

Performance Standards for Stage 2 Design and Technology

| | Investigating | Planning | Producing | Evaluating |
|---|---|---|---|---|
| A | <p>Clear, comprehensive, and well-considered identification of a need, problem, or challenge.</p> <p>Thorough and insightful creation and validation of initial design brief based on needs analysis and task identification.</p> <p>Purposeful investigation and critical analysis of the characteristics of a broad variety of existing products, processes, systems, and/or production techniques.</p> <p>In-depth investigation into product material options and focused and thorough critical analysis for product use.</p> <p>Focused and perceptive investigation into the impact of products or systems on individuals, society, and/or the environment.</p> | <p>In-depth analysis of information to develop imaginative, innovative, and enterprising solutions to an identified design brief.</p> <p>Accomplished communication of a variety of refined product design ideas, consistently using relevant technical language.</p> <p>Purposeful testing and refined modification and validation of ideas or procedures.</p> | <p>Sophisticated application of appropriate skills, processes, procedures, and techniques to create a product or system to a precise or polished standard and specification.</p> <p>Accomplished use of resources, equipment, and materials to create a product or system safely and accurately.</p> <p>Accomplished and resourceful development of solutions to technical problems that may arise during product or system realisation.</p> | <p>Insightful and well-considered evaluation of product success against design brief requirements.</p> <p>Insightful and detailed evaluation of the effectiveness of the product or system realisation process.</p> <p>Refined and well-considered reflection on materials, ideas, and procedures, with sophisticated recommendations.</p> <p>Resourceful and well-informed analysis of the impact of the product or system on individuals, society, and/or the environment.</p> |
| B | <p>Well-considered identification of a need, problem, or challenge.</p> <p>Well-considered creation and validation of an initial design brief based on needs analysis and task identification.</p> <p>Thoughtful investigation and analysis of the characteristics of a variety of existing products, processes, systems, and/or production techniques.</p> <p>Detailed investigation into product material options and thorough analysis for product use.</p> <p>Some depth of investigation into the impact of products or systems on individuals, society, and/or the environment.</p> | <p>Thoughtful analysis of information to develop enterprising solutions to an identified design brief.</p> <p>Capable communication of different quality product design ideas, using relevant technical language.</p> <p>Thoughtful testing, modification, and validation of ideas or procedures.</p> | <p>Capable application of appropriate skills, processes, procedures, and techniques to create a product or system to a mostly precise or polished standard and specification.</p> <p>Capable use of resources, equipment, and materials to create a product or system safely and mostly accurately.</p> <p>Thoughtful development of solutions to technical problems that may arise during product or system realisation.</p> | <p>Well-considered evaluation of product success against design brief requirements.</p> <p>Well-considered and detailed evaluation of the effectiveness of the product or system realisation process.</p> <p>Well-considered reflection on materials, ideas, and procedures, with thoughtful recommendations.</p> <p>Well-informed analysis of the impact of the product or system on individuals, society, and/or the environment.</p> |
| C | <p>Considered identification of a need, problem, or challenge.</p> <p>Considered creation and validation of an initial design brief based on needs analysis and task identification.</p> <p>Competent investigation of the characteristics of some existing products, processes, systems, and/or production techniques.</p> <p>Competent investigation into product material options and analysis for product use.</p> <p>Generally thoughtful investigation into the impact of products or systems on individuals, society, and/or the environment.</p> | <p>Analysis of information to develop appropriate solutions to an identified design brief.</p> <p>Competent communication of product design ideas, using appropriate technical language.</p> <p>Competent testing, modification, and validation of ideas or procedures.</p> | <p>Competent application of skills, processes, procedures, and techniques to create a product or system to an appropriate standard and specification.</p> <p>Competent use of resources, equipment, and materials to create a product or system safely and generally accurately.</p> <p>Development of appropriate solutions to technical problems that may arise during product or system realisation.</p> | <p>Considered evaluation of product success against design brief requirements.</p> <p>Considered evaluation of the effectiveness of the product or system realisation process.</p> <p>Considered reflection on materials, ideas, and procedures, with appropriate recommendations.</p> <p>Informed analysis of the impact of the product or system on individuals, society, and/or the environment.</p> |

| | Investigating | Planning | Producing | Evaluating |
|----------|---|---|---|--|
| D | <p>Identification of a basic need, problem, or challenge.</p> <p>Creation of a basic initial design brief with some consideration of a needs analysis.</p> <p>Identification of the characteristics of some existing products, processes, systems, or production techniques.</p> <p>Some basic description of material options.</p> <p>Some description of the impact of products or systems on individuals, society, or the environment.</p> | <p>Some identification of information to attempt basic solutions to an identified design brief.</p> <p>Basic communication of some product design ideas with some use of appropriate technical language.</p> <p>Partial testing and some modification of ideas or procedures.</p> | <p>Partial application of skills, processes, procedures, and techniques to make one or more articles to a limited standard and specification.</p> <p>Some use of basic resources, equipment, or materials to create a product or system, with some consideration of safety aspects.</p> <p>Partial development of some basic solutions to technical problems that may arise during product or system realisation.</p> | <p>Description of product progress, with elements of basic testing against design brief requirements.</p> <p>Some description of the effectiveness of the product or system realisation process.</p> <p>Superficial reflection on or description of materials, ideas, or procedures, with basic recommendations.</p> <p>Some consideration of the impact of the product on individuals, society, or the environment.</p> |
| E | <p>Limited identification of a need, problem, or challenge.</p> <p>Creation of a very basic initial design brief, with support.</p> <p>Statement of one or more characteristics of an existing product, process, system, or production technique.</p> <p>Limited description of one or more product material options.</p> <p>Identification of one impact of a product or system on individuals, society, or the environment.</p> | <p>Attempted identification of some information to develop limited solutions to an identified design brief.</p> <p>Limited communication of one or more product design ideas.</p> <p>Some attempt at testing and limited modification of an idea or procedure.</p> | <p>Attempted application of one or more skills, to follow an appropriate process, procedure, or technique.</p> <p>Attempted use of resources, equipment, or materials, with emerging awareness of safety issues.</p> <p>Some attempted description of problems that may arise during product or system realisation.</p> | <p>Identification of some product progress, with limited testing.</p> <p>Identification of some aspects of the effectiveness of the product or system realisation process.</p> <p>Identification rather than description of materials, ideas, or procedures, with one or more recommendations.</p> <p>Emerging recognition of one or more of the impacts of the product on individuals, society, or the environment.</p> |