The Pyrenees Heritage Preservation Magazine

GOLDSMITH

No 149 October 2018

Lake Goldsmith Steam Preservation Association Inc

Registration No:- A0032895

Rally Grounds:-

1234 Lake Goldsmith-Carngham Road
Lake Goldsmith Vic. 3373

Next Rally No. 112

LAKE GOLDSMITH SPRING RALLY Nov 3 & 4 2018

Highlight Theme:-

Vintage Road Making

70 Years of Land Rover

Foden Parade

Plus Pre-rally All Makes Tractor Trek on Friday Nov 2 2018

The highlight theme of “Vintage Road Making” will see vintage machines in action building a road area in the arena.
The Landrover display will be in the Quadrangle & the Fodens on the Arena

Editors Overview

Welcome to Goldsmith 149, October 2018

Hello Readers.

The 112th Rally is nearly with us and the action theme of road making promises all of the action that we have seen with similar themes of earthmoving and logging.

The period of interest is from the start of mechanised road building, through a transition period from before WW1 to after WW2 when draft animals still worked beside early tractors pulling horse drawn gear, and trucks replaced drays

A second transition phase saw the first self propelled road making machines powered by steam replaced by petrol and diesel powered alternatives. Steams power dominated heavy work until large powerful IC engines were reliable enough to surpass them. Steam rollers hung on as their natural weight was not a disadvantage, and steam wagons survived for tar spraying and face shovels and drag lines became one man machines when powerful Diesel engines became available.

As fortune has it much of that era was recorded on early silent black and white movie film. In particular the NSW Dept. of Main Roads has made much of this available on line and I have taken some samples from these films for some real life action of the life and times of the builders of roads in the transition period from horse to machine

The films are all old and vary in condition, and my recording by camera and attempts to correct some of the extreme contrast has limitations. In spite of this deficiency on my part the pictures give an insight into the men and machines that ushered in the modern era of powerful dedicated road building machines.

Google:-   youtube roads and maritime construction pacific highway 1928

The President, Committee (and Editor) hope that you find something of interest in this October edition 149 of Goldsmith.

A HD print quality version of Goldsmith 149 will be available from the website as usual at:-
www.lakegoldsmithsteamrally.org.au/magazine.html
Thanks to Eva's Gallery for many of the action Rally Pictures, if you would like a copy contact the editor.

Mission Statement

To foster, nurture, encourage and demonstrate technical, agricultural and life skills associated with the Industrial Era.
To provide a quality environment where these skills may be used to educate and entertain members and visitors.
To run two weekend rallies each year, and be available at convenient time for other interested groups or individuals.
To conserve and develop a heritage collection.

Find us on the net at:- www.lakegoldsmithsteamrally.org.au
Or contact us by email:- info@lakegoldsmithsteamrally.org.au
Or write to:- **The Secretary:- P.O. Box 21 Beaufort 3373**
Or contact the editor:- goldsmithgazet@optusnet.com.au

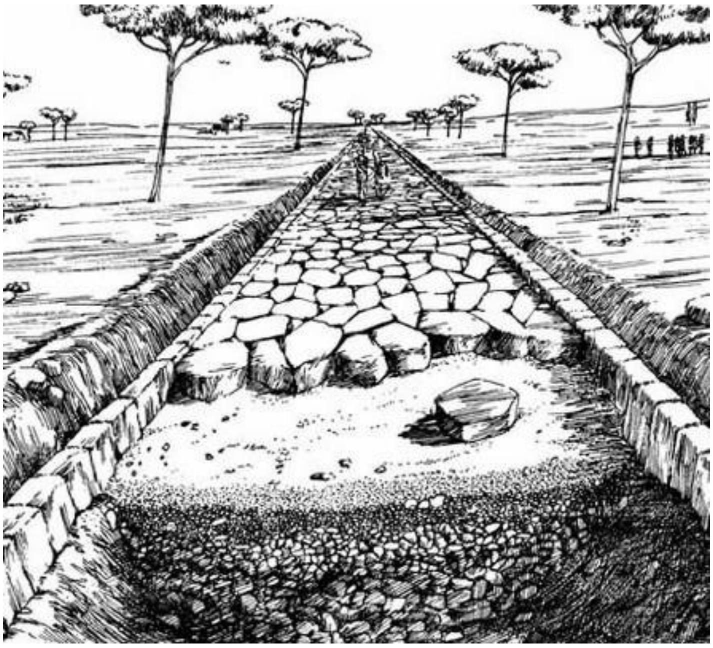
To register for this "cost & obligation free" bi-monthly e-magazine
email:- goldsmithgazet@optusnet.com.au **or Ph 0425 744 052**

Road Building Origins

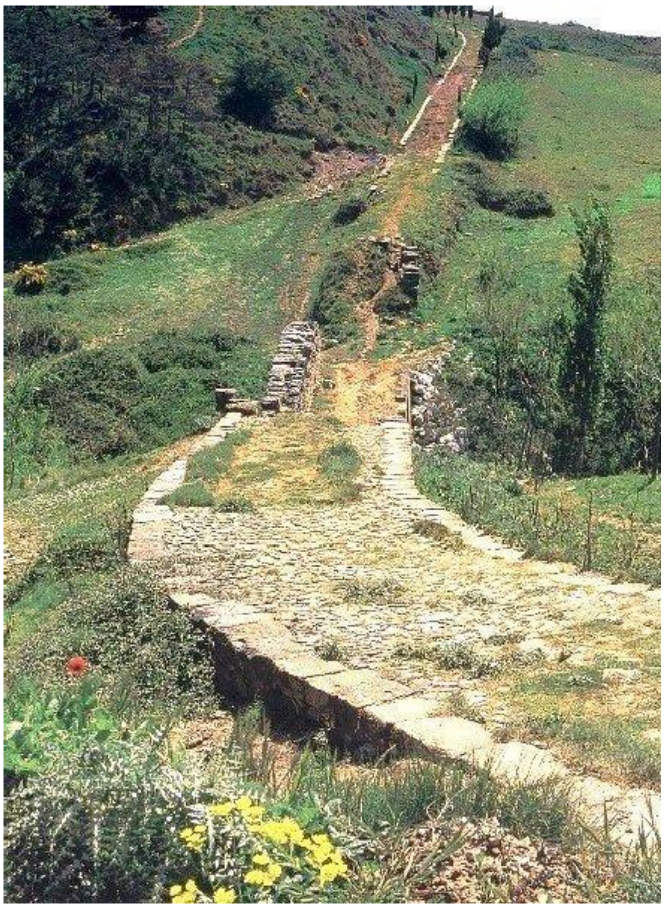
For this exercise, only roads that required some sort of design and construction will be considered. Even with this limit road building has had a long history, particularly after the wheel was invented and the drivers of the day figured out that you could carry a lot more on a gentle grade with a hard surface. We have just got better at it, and by developing equipment and techniques that can build roads faster and cheaper, goods and people can move around in ways inconceivable to those who got the idea going endless centuries ago.

The Romans did not invent roads but they certainly put them on the map, about 250 000 miles of them, about 50 000 miles of which were paved in stone many of which survive today, some of which are still in use, in some way today.

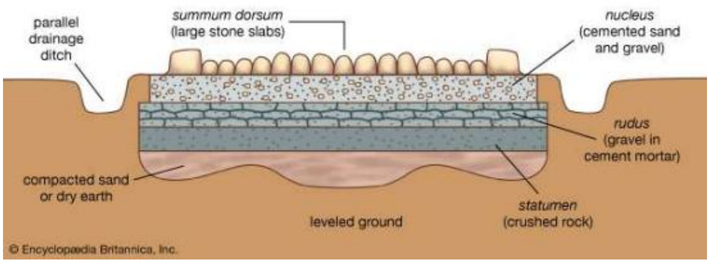
Their early roads were as straight as possible (by decree) which made them steep in places, For marching this had the advantage of short distances, but for commercial and wheeled transport this was limiting and later roads were longer with more curves, gentler grades, and wider pavements, usually about 12 feet but this varied in places to accommodate 2 way cart traffic and pedestrians. (cart bodies were about 4’ wide) .



On the left, a section through a major Roman Road shows that they went to a lot of trouble to allow water to drain away in the lowest level, while wheel and foot loads were spread across a stabilised base under a surface of stone slabs.



On many roads the surface slabs were cemented in to form a smooth surface. Kerbed edges on the pavement minimised edge damage. Roads were elevated above the adjacent ground, or gutters were dug to minimise water damage by directing it away from the road base.



The picture above gives a good idea of the construction methods used which allowed the road to survive the elements for centuries. The picture below shows the effect of heavy wheeled use, and the advantage of hard longwearing surfaces.

On the right, this road in Pompeii shows elevated footpaths to keep your feet dry as the road was also the surface drain for storm water and other waste.

Vehicles only had limited access to roads in towns and cities, and the use of the highways or Viae generally involved paying tolls along the way and at city gates.

The highways were vital for troop movement around the empire, and it was the military that built them. Workers were sourced from the legions, and each Legionnaire was issued with weapons and tools for working.

The backbreaking work developed the strength and stamina which made them unbeatable in battle.

Criminals, slaves, and prisoners of war were conscripted for quarrying , transport and for repairs. The whip was in constant use and on occasions the nature of the work, on occasions, led to mutiny in the ranks.

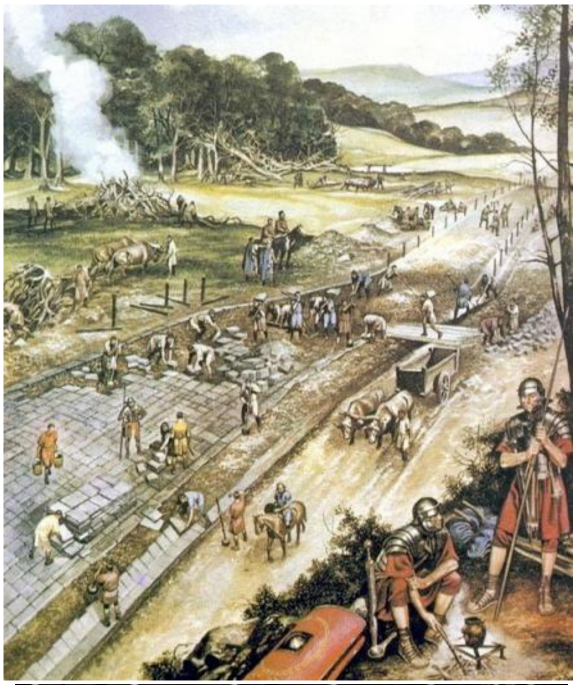
Not all roads were built to the high standards of the Viae, and construction varied from place to place dependant on the use of the road and the nature of the ground and the materials that were available.

The depth of the road bed varied greatly as they were excavated to find a stable base. In places they were 15’ (4.5M) thick, although 4 to 5’ (1.5M) was more usual

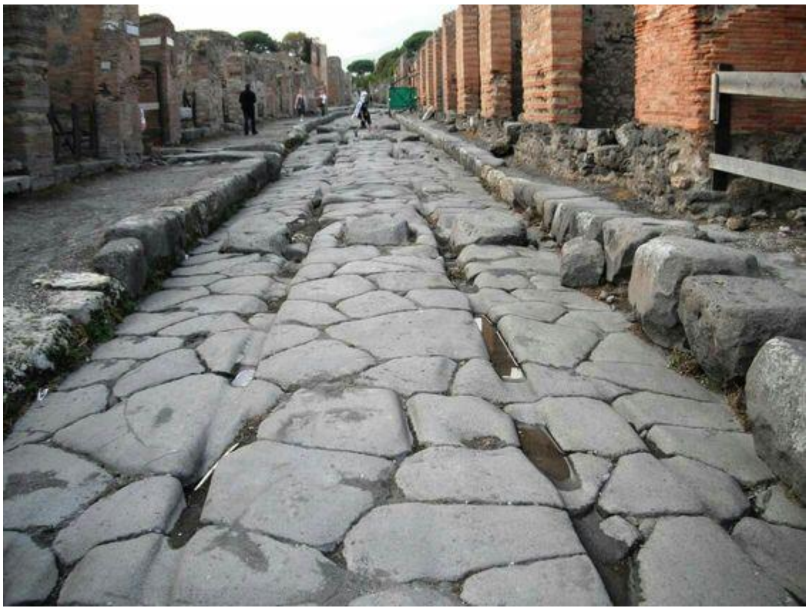
Where ever it was available the upper sand and gravel layers were cemented to improve water sealing and to provide a strong, stable, low maintenance bed.

The cement that they used was different to the Portland cement that we use today.

Lime, made from a low temperature heating of limestone was mixed with water and Volcanic Ash which contained Silica and Alumina.



The liquid was poured over the stone bed and provided a strong bed with very good water resistant properties. When mixed with crushed Terracotta it formed a waterproof concrete used for aqueducts and harbours where its



salt water resistant properties have allowed it to survive into modern times.

The pavement stone were normaly about 15cm (6”) thick .

The Roman military required all vehicles to have the same axle length so that all wheels had the same track which forced them to follow the grooves worn in the hard stone road pavement. Chariots where being superseded by Cavalry about the time the Romans started building main roads c500BC.

Wagons used the same track and grooves, which to some degree made them self steering , but a major advantage would have been to minimise wheel breakage which would result from wooden spoked wheels trying to ride out of the groove.

The Romans used standard units of measurement. The Mille or Mille Passus (A Roman Mile) was a thousand paces (1 Left + 1 Right was a pace). It was defined by decree in 29AD as 5000 Pedes (Roman feet), and a League was 7500

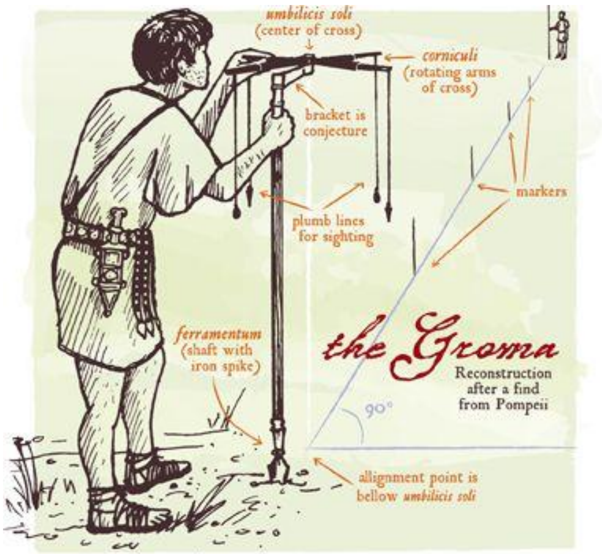
Roman Feet. The Stadia (from Greece) was one Eighth of a mile (625 Roman feet)

5000 Roman feet is equal to 4860 Imperial feet (1.481km) so a Roman Mile was 0.9205 of an Imperial Mile which is 5280 Imperial feet (1.609) km). The imperial Furlong (1/8 of a mile) was 660 feet (±201 Meters)(or 10 Chains for those who remember the original decimal system that was used to survey Australia)

Going downsize from, Pes (single Roman Foot

(296mm)) was divided into 12 Uncia (24.6mm).

The main roads had a Milestone every mile on their main Roads with distances to towns. There are about 100 of these milestones surviving in England and Wales alone.



Castra's, built to barrack troops were built at regular intervals along the major roads. Ox Carts could travel about 15 Roman miles or 10 Leagues a day, and there were Mansio's (official guest houses) built to accommodate travellers at night.

The Roman Military Engineers who built these roads used early survey methods to keep these roads straight and within the gradient limits (±1 in 6). They achieved some amazing results. Roads built through hilly timbered country have been found to be within 2 metres of straight over distances of nearly 30km.

They use a variety of instruments from sighting/ measuring rods/poles for alignment, and ropes tensioned with weights to reduce stretching errors, to measure distance. Their Decempeda was a calibrated metal capped rod 10 Roman feet long. These were butted end to end for longer measurements.

The main instrument for alignment was the Groma (see right above) which used 4 plumb bobs set at 90° from the intersection of two arms, which were offset from the support pole to minimise blind spots.

To extend a line forward, 2 opposite strings were moved to line up with sight poles on the existing line, the operator then moved 90° or 180 ° around the Groma and set new sight poles in a straight line, or at a Right Angle to the main line.

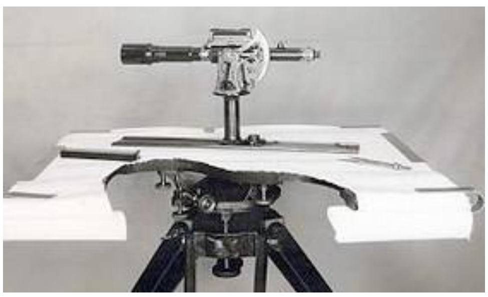
To set a forward line at an angle other than 90°, a sight pole was set at a predetermined offset from a forward pole at a known distance from the Groma. The Groma was then set in line with the new offset sight pole and they moved on along the new line.

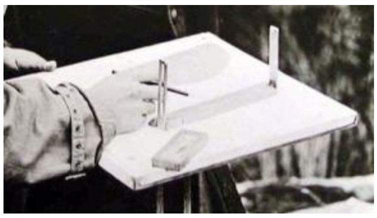
If a road had to change direction, it generally did so on a hilltop or ridge. The Romans had a good working knowledge of Geometry and Trigonometry which amongst other things, had been acquired from the earlier Greeks.

Their major achievement was to develop and combine these early concepts to a point where they could be applied to advantage and used to survey sites and construct Aqueducts, Roads and Bridges.

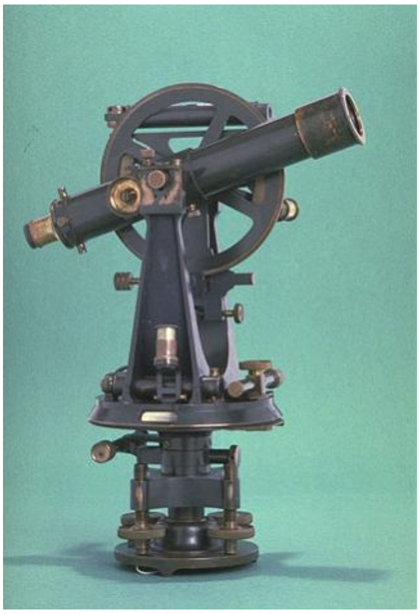
For more precise work the Dioptra, first described by Hero of Alexandria in the first century AD, was an early for-runner of the Theodolite .

In its simple form it consisted of a flat plane which was set level using 4 levelling screws and two water level grooves set at right angles to each other. A sighing bar or tube was mounted on a central pin on the board so that it could be pointed in any direction. Calibrated marks in a circle about the central pin allowed directions to be read and an angle between two sightings could be obtained by subtraction.





One end of the sighting bar could be elevated and an angle above or below the horizontal board could be measured. Two Dioptra set a known dis-



tance apart could be used to fix the position and elevation of a point visible to both. Variations of this devise survived into Modern times, Plane Tables, some with optic Alidades (see left lower corner, last page)) and were used by map makers to prepare contour and other plans for Military and Engineering applications.

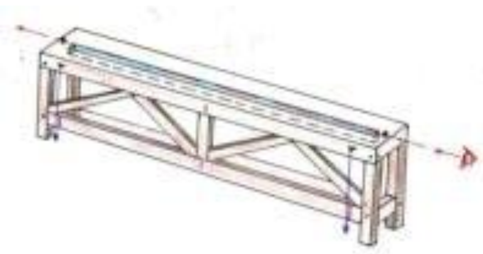
The Dioptra could also be used with the board mounted in a vertical plane and the sight bar or tube used to read vertical angles or set grade lines for road building. (see previous page).

Setting grade lines for Aqueducts required builders to hold small angles to a very close tolerance.

Eventually in the 1500's the horizontal and vertical circles were combined in the one instrument and the Theodolite was born, (above) and it is still with us today in many shapes and forms, and it became the basis of the Total Station introduced by Hewlett Packard in the 1970's which combined electronic distance measuring and calculation of Horizontal and Vertical distances.. In time this led to the modern Robotic Total Stations which allow one person to complete a topographic field survey.

Back to the Romans!

Other tools used by the Romans were the Libella (right above). This "A" framed instrument had a plumb bob attached to the apex of the frame, and a reference mark on the bridge. This was their equivalent of the spirit level, and it shared the same self check ability by end reversal. The spirit bubble level did not arrive until c1660.



Their other devise for levelling was the "Chorobates" (left) which, like the Libella, had Plumb Bobs, but they were used at both ends of a longer frame (up to 6M) . The top of the Chorobates had a channel that could be filled with water, and sighting notches that let the surveyor project a level line forward. These devices were important when building aqueducts where the invert gradients were typically, 0.15% to 0.3% (1 in 700 to 1 in 350) with extremes from .07% to 3.0% (1 in 1500 to 1 in 33). When flowing, surface Gradients may have been greater, particularly on vary shallow gradients. Water will flow until the surface is level.

The gradient and water velocity, was important, as it had to be great enough to keep sediments in suspension, and slow enough to minimise erosion and damage.

Not all tunnels made by the Romans were for Aqueducts, in c37BC they dug a 1KM long Road Tunnel near Naples, starting from both ends.

In c75AD they built the 33M Furlo Pass Tunnel which was 6M in diameter. This is still in use as a road Tunnel today. One drainage tunnel started in 41AD. It started from one end and proceeded forward in 35M stages from a succession of vertical shafts up to 122M deep. It was 5.6km long and took 30 000 workers 11 years to build. Now back to the Roads!

One other tool that the Romans used on their Roads was the “Hodometer”. This devise was the Roman equivalent of the measuring wheel which was described by Hero of Alexandria, although it appears to date from an earlier time.

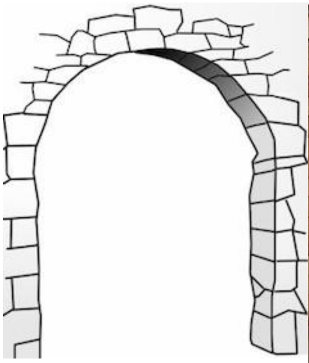
The wheel had a known circumference, which was pulled along the road to measure distance. The ground wheel was connected to a magazine of stones via a system of wooden gears. These gears were timed to let a stone fall from the magazine into a container at prescribed distances.

At the end of a measured section the stones in the container were counted to reveal the travelled distance.

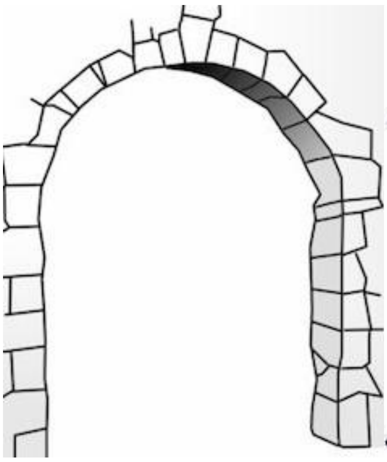
The model of a recreated Hodometer on the right shows a magazine of 8 stones, which may have represented the number of Stadia travelled, or maybe there was an 8 mile magazine. Either way this was a neat attempt at measuring and automatically recording a distance.

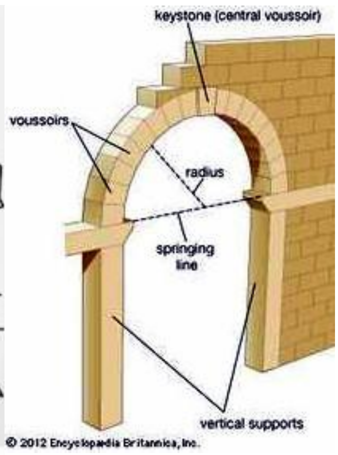
This machine, and the Dioptra required a good mathematical knowledge to design them, and they required a high degree of skill to manufacture. How frequently these machines were used is not known.

The other structures that the Romans used in their Roads and Aqueducts were Bridges.



The semi circular Roman Arch was a common feature in Roman Architecture and Engineering. Their early arches did not use keystones, instead the stones around the arch were corbelled, or gradually canter-levered over the opening until the arch was completed. This type of construction had been in use around the world for 1000’s of years before the Romans, and is still used in brick Architecture, as can be seen above on the right.



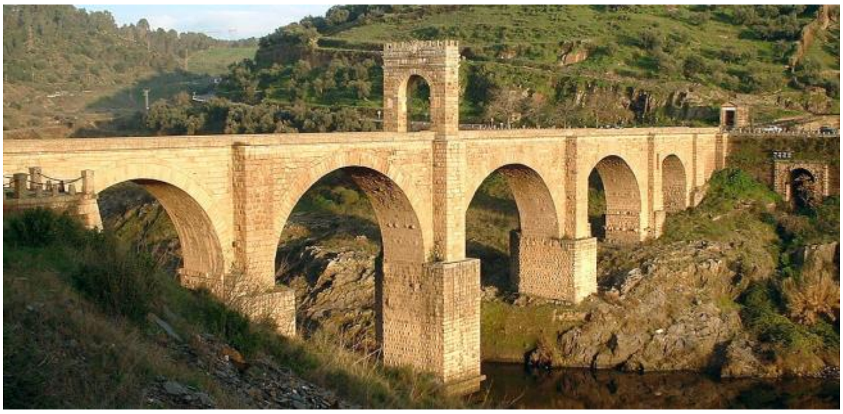


The Romans developed a true semicircular arch as shown in the sketches on the left. These arches allowed high compressive loads to be carried around the Arch from the central Keystone to the structure below, and beside the Arch allowing them to span wide gorges.

The Arch provided a means of spanning large distances across gullies using a single Arch, as seen on the last page, or a series of Arches, using a minimum amount of material and labour.

The Bridge on the right was built in Spain near the Portuguese border at the end of the first century AD.

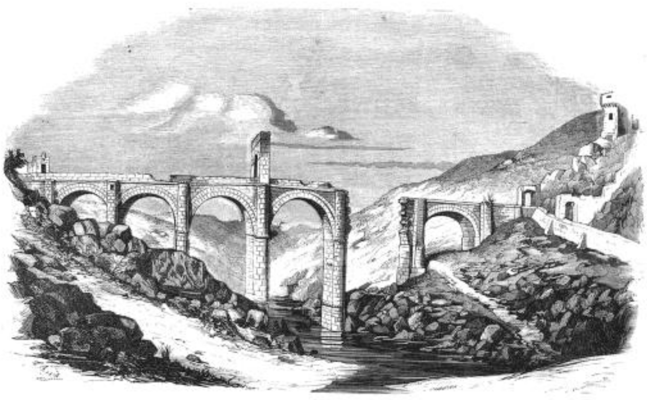
It is 190m long, 8 wide and 57m high and the longest span is nearly 30m.



The water is 11m deep and rises another 44 at peak flow. It has been in use for most of its 1900 years, and it is still in use today.

The architect who designed it was so proud of it that he asked to be buried near it.

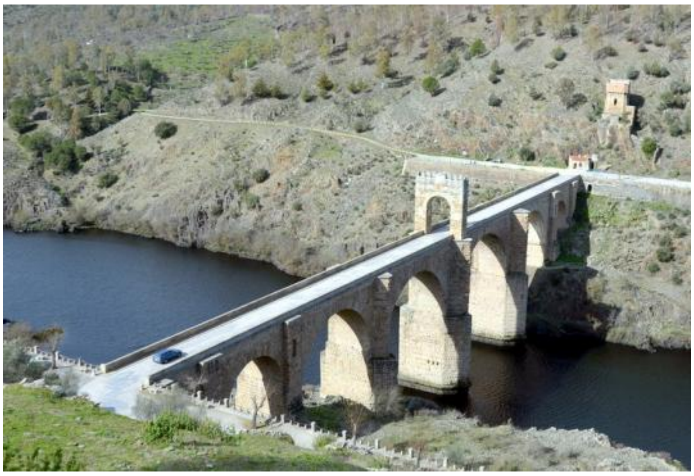
It has had a single arch destroyed on three occasions, in 1207 by the Moors, in 1760 by the Spanish and again in 1836 by retreating armies. The last rebuild was in 1860, and in 1969 when a new dam built upstream allowed the water level to be lowered, and repairs were made to the base of the central columns.



PUENTE ROMANO DE ALCÁNTARA.

The sketch on the right was drawn in 1857 before the final repair in 1860. The early picture below was

taken in 1870 from the other side, and the unweathered repaired Arch can be seen on the left of the centre.



The overview on the right shows the road abutments and the defensive fort beyond the pavement.

On the left, is a view of the stone pavement, kerbs, Triumphal Arch and the Temple to Emperor Trajan and the Roman gods. The central Arch records the build information and records the 11 municipalities that contributed to the cost of the Bridge.

It also shows the stones that formed the semicircular Roman Arch with some ornamental corbels and castellation's to cap it off.

This bridge must have been a masterpiece in its day, and its ability to survive the deliberate destruction of a single arch on three occasions and still be able to be rebuilt to full use by modern traffic is a testimony to the competence, confidence and skill of its designers and builders.

That it is able to handle modern vehicular traffic which would have been inconceivable to its builders 1900 years ago is a tribute to their Engineering and Surveying.

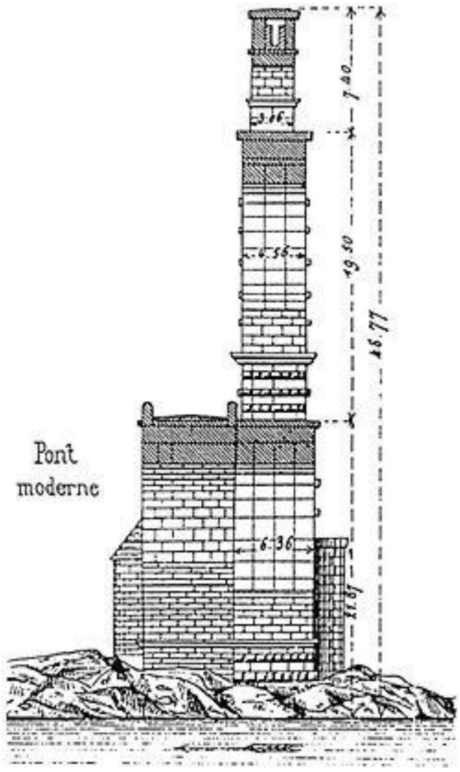
The Romans demonstrated their skills in making straight roads using direct and indirect survey methods.

For their Aqueducts they demonstrated their ability to follow natural curving contours with precisely controlled small gradients that were mentioned on page 7.

The picture above of the Aqueduct Bridge over the Gardon River in France, which carried water to the city of Nimes. It was part of the Pont du Gard Aqueduct which was 50km long between 2 places 20km apart as the crow flies. It is estimated that Nimes had a population of around 50 000 and the Aqueduct supplied about 40 000 cubic metres of water a day. It was in use from midway in the first century until the 6th century when it became blocked with debris and calcified salt deposits.

Most of the aqueduct was covered with stone slabs, and the Romans had maintenance crews who chipped away the calcified deposits and kept the water flowing.

The aqueduct falls 17metres over its 50km length which is an average of 1 in 3000. The aqueduct bridge is 48.8 metres high, probably the highest that the Romans built. If a uniform gradient had been used the bridge would have been 6 metres higher, that is 54.8 metres which would have increased the cost, and tested technical limits. (By comparison Melbourne's Westgate bridge has a clearance of 58 metres,)



To keep the Bridge as low as possible, the upstream channel ran at a steep gradient, and downstream of the Bridge the gradient was very shallow. The bridge section itself drops 25mm in its 496metre length, that is 1 in 18 000, and the average over the last 25km to Nimes is less than 1 in 4000, and in the curved section after the bridge it is around 1 in 14000, around 7mm in 100 metres, this is around 15 seconds of Arc. These are incredible achievements with the equipment that they had at their disposal.

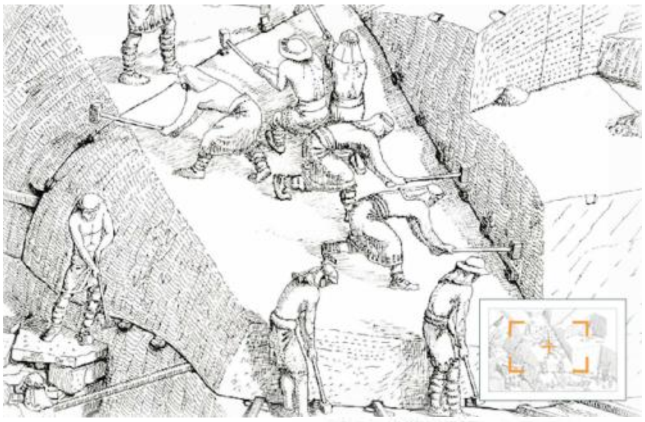
Building the channel is remarkable enough, they had to do the preliminary survey to figure out if it was possible, identify the problems and figure out if they could overcome them, and make sure that it would carry enough water. Then they had to build it.

The teams that built the roads had it easy.

By Clem Rutter, Rochester Kent UK

Map Pont du Gard Aqueduct France

The water conduit (left) was 4' * 6' and concrete lined. The main structure is un-cemented shelly Limestone. The Road bridge on the lower deck of the cross-section was built in c1745. Repairs have been carried out over the ages to correct erosion, damage and the removal of stone work, to preserve this remarkable achievement .



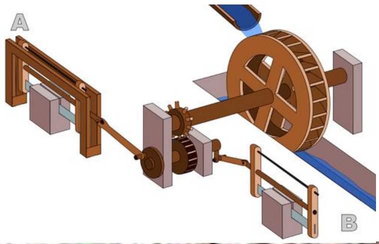
Much of the material for roads and channels had to be quarried, and shaped by Artisans for use in Bridges and road works.

Some stone blocks weighing many tons had to be transported, Roman road design used of concrete which created a demand for crushed rock in varying sizes, and crushed terra cotta for waterproof concrete.

Fire and water were used to heat and crack rock, but when water was available it was used to drive water wheels that drove stamp mills and reciprocating saws. The sketch below is from a woodcut made in the mid 1500's in Europe . I have not been able to find a sketch of a recreated Roman crushing plant, the records seem to be described in writing.

Their grain crushing plants were well established, with one in France (see right) driving 2 rows of 8 cascading flour mills in the mid first century. This is the oldest and largest powered industrial complex known. It indicates that they had a good working knowledge of what was achievable with the hydraulic technology available at the time, and the cost savings that it made possible.

They are also known to have developed reciprocating saws to cut wood and stone, as can be seen in the sketch. (right)



Drop hammer stamp mills, or the remains of them have been found at many sites, particularly at mining site where ore was crushed to recover gold and other precious metals.

The photograph, (right), is the bottom anvil stone from a Roman Stamp Mill Crusher in Spain.

The Aqueduct described on the previous page was built near the end of the era when multi level arches of solid stone were used.

Later designs used less material to reduce costs, as seen in the Aquedo de los Milago (below left) and the Aqueduct of Sergova (below) ,both in Spain, were built of dressed Granite at the end of the first century.

Later designs used more concrete to reduce the amount of material and increase the strength of the structures.

As more water became available the potential to power mills increased, and the reduced cost of crushing rock made concrete more available.

Water and wind power remained the main source of energy to power stationary industry plants until the arrival of steam many centuries later. Wind dominated transport by sea until the age of steam when the energy stored in fuel was able to reverse the use of the water wheel to deliver energy for motivation rather than absorb the kinetic energy of moving water as a power source. Draft animals and Man Power were the other source that did their bit too, and they dominated land transport until compact steam engines were developed.

Fuel was portable, and industry was no longer locked or limited by a source of wind or water. The ingenuity of the human mind was gradually freed to exploit the opportunities created by its use.

The Romans were amazing in their achievements. They recognised the advantages of good road design to serve an empire, and they developed the means to bring clean water to cities, and began an era of industrial change that freed workers from the hardships of manual labour.

It is interesting to contemplate what they might have achieved had they invented a pressure vessel.

Before we leave the Romans, the other fascination is the close match of the distance between the grooves worn in Roman Roads and the Standard Gauge Railway.

As was pointed out earlier, the Roman Military required that their vehicles all used the same axle length. It is presumed that this was done to minimise wheel breakage, and as the Romans used stepping stones to cross many city streets, (which also functioned as drains), there would have been an advantage if wheels passed through the gaps in the stepping stones. Common sense would indicate that the advantage of a standard wheel gauge would appeal to all vehicle users.

It seems that the grooves in Roman roads are very close to five Roman feet apart, which is about 4' 10 1/2" Imperial. (wear grooves tend to widen with use). (If R5' was C-C & rims were 2" wide it would leace a gap of 4'8 1/2")

If R5' is the distance between grooves, and given an inch wear on the inside edge of the groove we get a gauge of 4' 8 1/2" which is Stephenson's or Standard Gauge used on most of the worlds major railways.

Stephenson built his first Locomotives in the workshops of the Killingworth Colliery in 1814. The first railway that he built for Powered Locomotives (no draft animals) was at the Hetton Colliery and it was built with the same 4' 8" gauge that had been in the Killingworth Colliery (about 7km North of Newcastle) before the Steam Locomotive was built.

In 1825 Stephenson completed the Stockton and Darlington industrial railway and used wrought iron rails with a gauge of 4' 8 1/2". I do not know the reason, but it would be reasonable to increase the working flange clearance for a multitude of reasons after experience with the previous project.

There is no known evidence that Stephenson ever related his rail gauge to the grooves in Roman roads, or that he was even aware of them. He developed his Locomotive on an existing track and then optimised the gauge for his own reasons.

The Romans had about 2000 miles of paved road in Britain which were in use for the 400 or so years that they were there, and they mined Iron near Newcastle..

If grooves formed in the roads it would be reasonable to expect that vehicles would continue to use the same wheel gauge as the Romans, because the roads remained in use indefinitely after the Romans left.

Old Killingworth Locomotive, still in use.

Many early collieries used rails in the mines, but they were guide rails that allowed non flanged road wheels to go into the mines.

Whilst Stephenson did not take a direct lead from the Romans, it is not difficult to imagine that his gauge ended up so close by default, it was all set in stone, and too expensive to change, Victoria's broad Gauge, and other states narrow gauge are a living testaments to the cost and inconvenience of the unintended consequences caused by the failure to comprehend the benefits of Standards.

The Return of Road Building

With the collapse of the Roman Empire in Western Europe the infrastructure of roads and water supply gradually fell into disuse during the middle ages which went from the 5th to the 15th century.

Not a lot happened until the mid 1600's in England when Tolls were legalised on the Great North Road (right) as a means of raising funds to carry out maintenance. A toll gate was built and local justices administered the work.

In 1707 the first Turnpike Act was introduced in the UK allowing Trustees to collect Tolls at a "Turnpike Gate" and maintain sections of road in their area.

By 1825 there were over a 1000 Turnpike Trustees looking after 18 000 miles of UK roads.

Mile posts were a requirement and rules, such as "keep to the left" were introduced. In 1765 trusts could build new roads, and John Metcalf was the first road builder to build roads needed by the Industrial revolution.

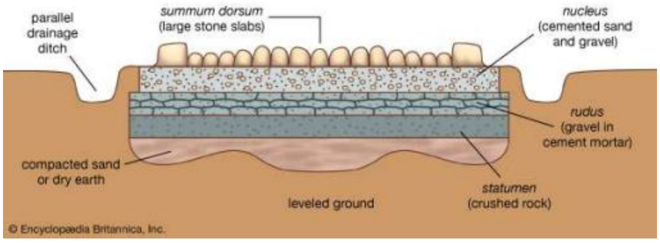
Tresaguet (1775) in France and Telford in the UK developed roads using large stones as a base to distribute wheel loads into the natural ground, covered by a layer of smaller stone or gravel on the surface.

John McAdam developed the first modern road, with a base of coarse 3"ɸ rocks with a capping of 3/4" ɸ stone on top. These roads used less material and carried greater loads, and they were adequate for Wagons, Coaches and Horses.

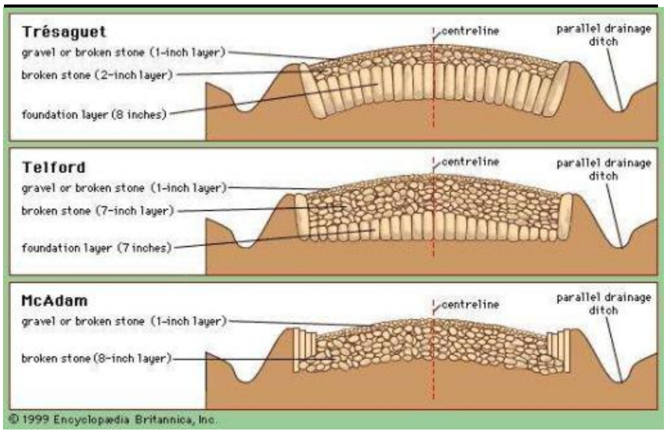
McAdam did not recommend the addition of tar, but later improvements were made by Edgar Hooley around 1900 when he developed and patented "Tarmac", which was a mixture of modified Tar and aggregate which was applied hot to the road subbase with a Steam Roller. The pressure for this smooth road surface came initially from " The Good Roads Movement " which formed in USA from around the 1870's and ran until the 1920's. Bicycle riders were foremost in this movement, and then car owners, and anyone else who wanted to reduce the amount of dust in unsealed roads. The seal also helped prevent water damage by diverting water to the gutters at the edge of the roads.

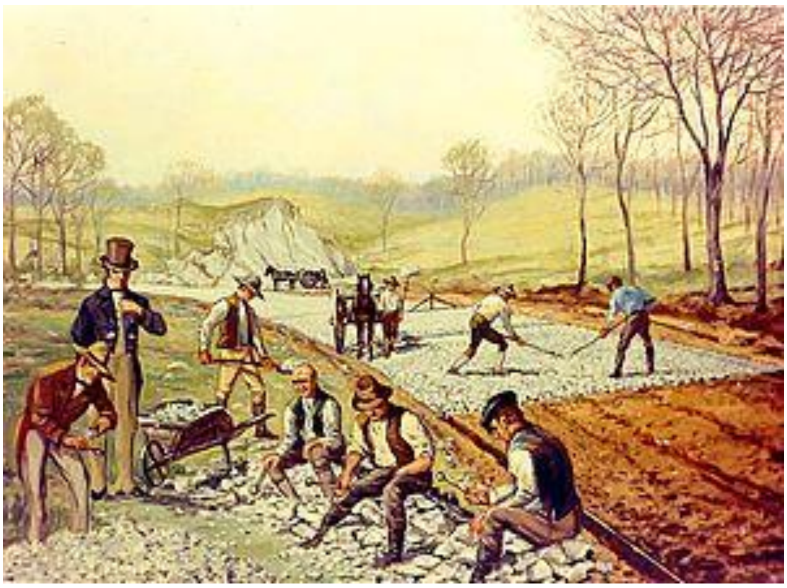
Roads have kept improving to meet the demands of heavier, faster and denser traffic

Our road making at the November Rally will not be to highway standard but will depict the equipment in use before and after WW2.



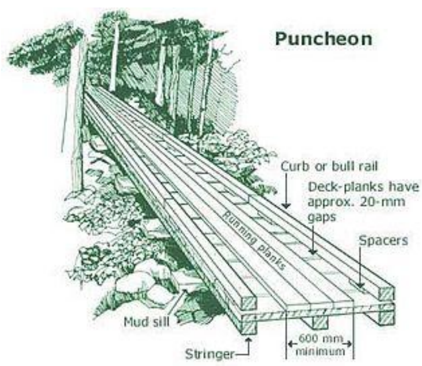
Typical Roman Rod Crossection





Left:-

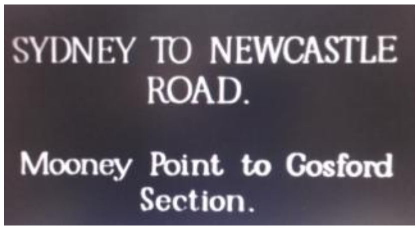
Hand checking stone size for use on an early McAdam road in North America

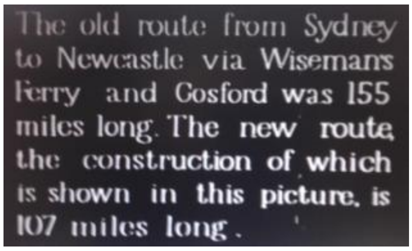


Timber Road Canada and NE USA

Road Making in NSW 1928

The following series of pictures were taken from a silent movie made by the New South Wales Department of Main roads in 1928. The road under construction was the section of the (Old) Pacific Highway between Mooney Point on the North bank of the Hawkesbury River and Gosford on Brisbane Water, about 17Km North East as the crow fly's, and 35Km by road.

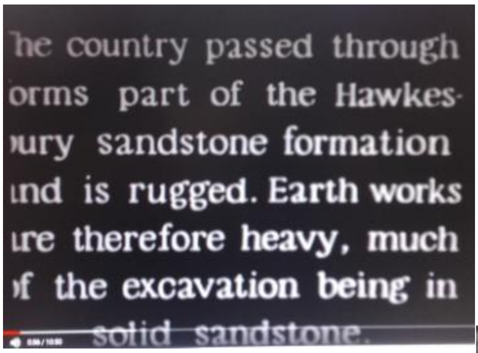




The aerial picture on the left shows the road in the Mooney Mooney Creek area, and the bridge crossing of the Mooney Mooney creek can be seen.

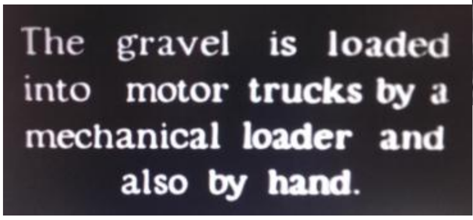
The countryside is mainly Timbered mountainous sandstone.

The film has deteriorated with time, but even so it offers an insight into road construction in the transition era when horses were being replaced by machines that drew the same machinery. Self propelled special machinery had not arrived in any quantity, and manpower was still employed to smash sandstone blasted out of the mountainside. Large rocks were set in place by hand and smaller rocks were smashed into place between them to build a Telford Road base which suited this circumstance in that blasted rock did not have to be crushed too small. Most of the pictures are self evident as to what is going on, so The original screen descriptions are included

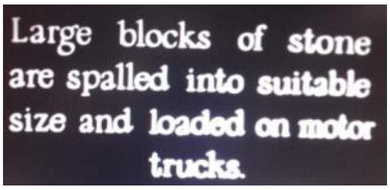


The film is interesting in that the equipment in use was drawn by horse and tractor. Steam was used to roll roads, drive the bridge piles and pump creek water for gravel settling.

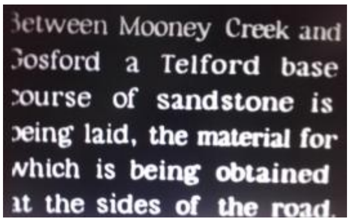
The sandstone was blasted and the rock was then reduced to manageable sizes by hand using sledgehammers



Trucks were used to move stone and spread gravel. Some gravel was loaded by machine which was fed by hand, and rocks were loaded by hand. The size rocks



needed for the Telford base could be lifted, carried and positioned by hand. The base stones are laid on a graded base and then knapped down and bedded in with sledge hammers



Below, Gravel is taken from the pit and shovelled direct

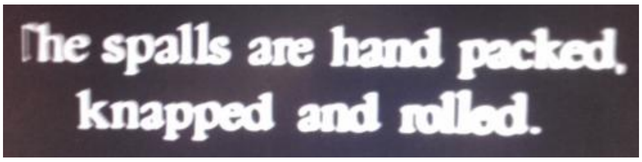
into trucks or a bucket elevator.

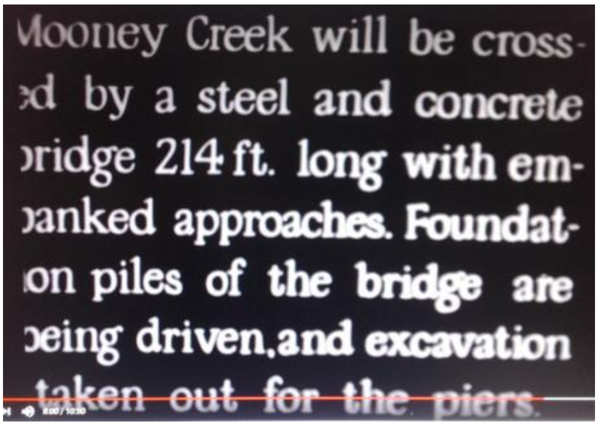
The bucket elevator is built on a Fordson tractor and driven from the PTO. I presume that it was towed into place, or pushed back into the heaped row of gravel.

The truck spreads the gravel over the base formation and raked out by hand. The horse drawn water cart delivers water

to bed the gravel into the base material before the steam roller moves in to press it into place. The steam roller seems to have been well used before and after the base stones were put in place. The solid rubber truck tyres seem to be the ideal tyre for driving over

the course base stonework and the rough hand fin-ished excavation. Some embankments required dressed stonework and gully drains.

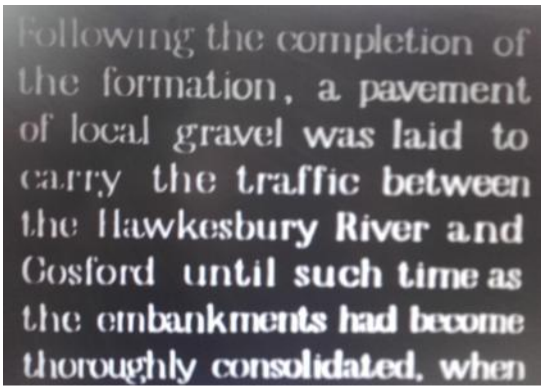




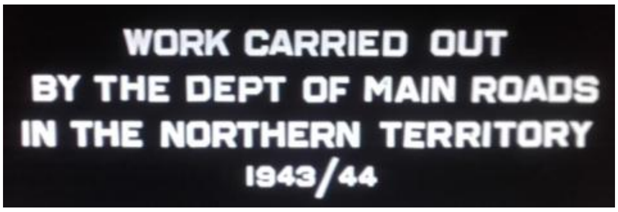
Above, is the steam pump providing water for the horse drawn carts, and next (above) picks and barrows are being used to excavate for the bridge abutments. The steam pile driver (above left) and the temporary bridge over Mooney Mooney creek are shown above left. On the right the finished gravel surface was in service to allow consolidation before the road was asphalted.

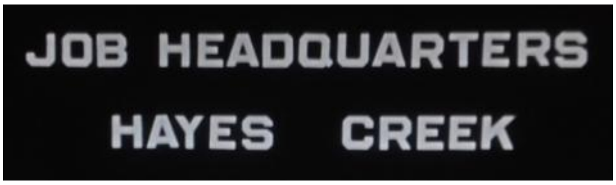
Below, by way of comparison, about 40 years later the new expressway passes the old highway and the equipment in use made the backbreaking manual work of the past a distant memory.

Google:- Construction of The Great Northern Highway from Hornsby New South wales 1928 it is in the sidebar
This film is a credit to all of those who built those roads. Ed



War Time Road Construction in the Northern Territory by the NSW DMR 1943/4





The DMR had made the road South from Darwin in 1941. The camp for this project was at Hayes Creek, about 50Km South of Adelaide River, and 140Km South of Darwin.

The machinery for road construction improved during the 1930's. Crawler tractors, Bulldozers, Graders and Scrapers were added. The Face shovels were Petrol or Diesel rather than steam, and excavated the trench for the segmented steel drain pipes being assembled insi-tu. The trucks were modern with K and D series International and Fords.

The International Crawler and scraper saw plenty of action excavating for the road base. These machines would only have been a dream to the DMR team who built the Pacific Highway in 1928.

The towed powered belt elevator made short work of filling these trucks

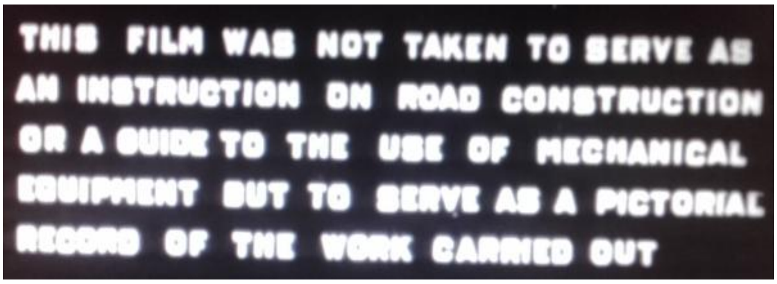
The other side of the elevator had a large plough disc cutting the base trench. They could be used to move the soil to crown the road centre or fill the trucks as seen above and on the left.

Bodywork modifications and driving positions varied with individual preference, I can only image what an inspector would do today, hopefully he would think it was a dream and find a chair, as for OH&S, they would run out of paper. We were different people then.

The road plant had its own crushing and screening plant, and the ground drive sweeper followed up.




A towed sheep's foot roller and a diesel roller and the tar plant was on site. As always, there is always some heavy work to do by hand. This was hot and dusty work done under war time conditions.





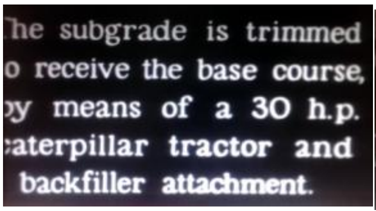



The section of road South of Darwin The Albion truck, and the Side loader chute to fill trucks. The "C" Cab D series Inter certainly saved removing the doors, and the steam winch ran the Pile Driver. The Air compressor sits over the cross boards of the undecked bridge. Ed.

Some other DMR NSW road making pictures from 1928 have been taken from various projects

The Cat 30 was an early contender for 1928, seen on the right dragging a ripper in the top picture. Next down it is towing 3 tipping scrapers. Third down it is pulling a Grader. It had a mate with an angle blade.

A Hotmix Batch Plant was filled from barrows and buckets, and a steam shovel loaded rocks.



The Steam Shovel also loaded horse carts. One bucket full is enough to fill a single axle dray.

The horse here also pulled a light grader and another pulled a water cart to bed material down.

In spite of the machines and horses, a lot of manpower went into building roads with a Telford base. For the roads on these 2 projects, the knapped in base stones formed an 8” layer, covered by Tar Macadam 3” layer of coarse hot-mix, covered by a 1/2” fine top layer. Each layer was rolled.

The surface finish of the face left by the shovel can be compared with the Telford base below, and finished top layer below it. A set of edge boards are being placed with boning rods as an alternative to stone edging.

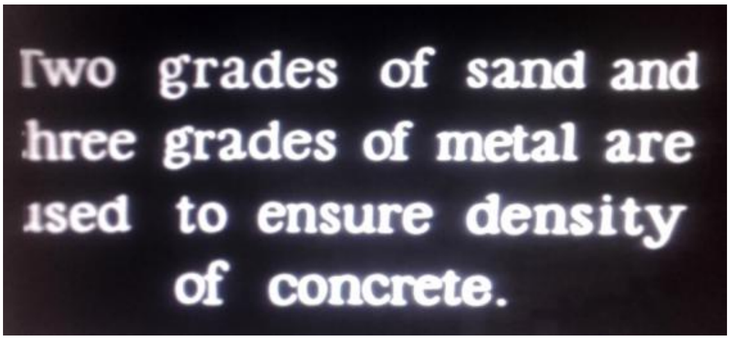
Concrete roads were also made. The excavation was similar to the forgoing. Concrete did not arrive in ready mixed trucks from fixed batch plants, it was made on site

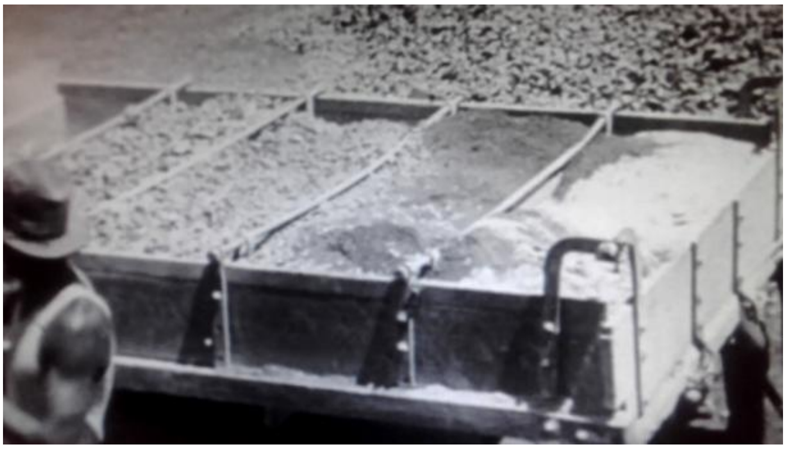
The series of pictures on the next two pages show how a self propelled mixer fitted with a truck sized loading hopper and a concrete kibble on a monorail was used in the construction of a road.

One lane was completed to allow it to be used by traffic while the other lane was made. The surface was laid in large blocks, and the cross and centre construction joints were later filled with tar.

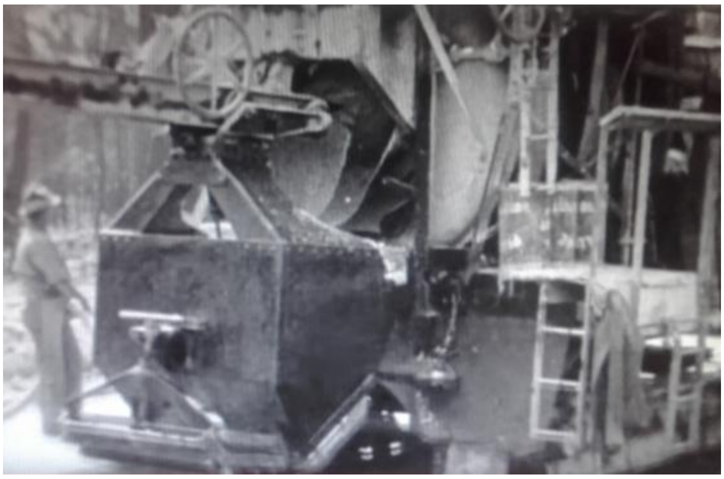
The concrete aggregate mix was controlled by a series of hand filled partitioned bays on a tip truck tray, with the cement added on top. This load was tipped into the mixer for 1 1/2 minutes and the kibble was filled and moved forward to dump it on the roadway..

The concrete was hand spread and screeded and covered with hessian for a day and then wet dirt for 21 days to cure. It was then graded off and the road opened to the public while the job continues on the other lane. Follow down on both columns, and the same on the next page.





Concrete road continued from previous page.
These pictures are a real look into the past. Ed.



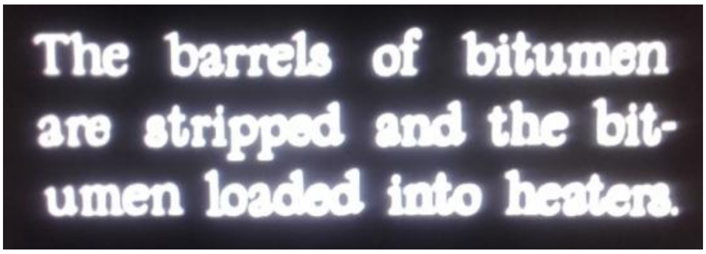
Tar was used as surface seal and binder on some McAdam surfaced roads. Before bulk transport, Tar arrived in hooped timber barrels on drays or trucks that were rolled off and stored on site.

The barrels were striped and the solid tar core was rolled into a heater that raised the temperature of the tar to 350°F using the wood from the barrel staves for fuel.

The hot tar was pumped into a Sentinel Steam Waggon which was fitted with a spray boom across the rear of the truck near the road level.

Prior to spraying, the road base surface was sweep to remove as much dust as possible, to ensure the maximum adhesion the road metal, and clean fine surface metal was laid in a strip along the verge of the road surface.

After the tar was sprayed fine surface material was shovelled by hand in a uniform layer over the hot tar before a following steam roller pressed this surface material into the tar to form the finished road surface



The Steam wagon, with its own heat source, was ideal for tar spraying. Bulk handling, labour saving and a common diesel fuel ended a colourful era.

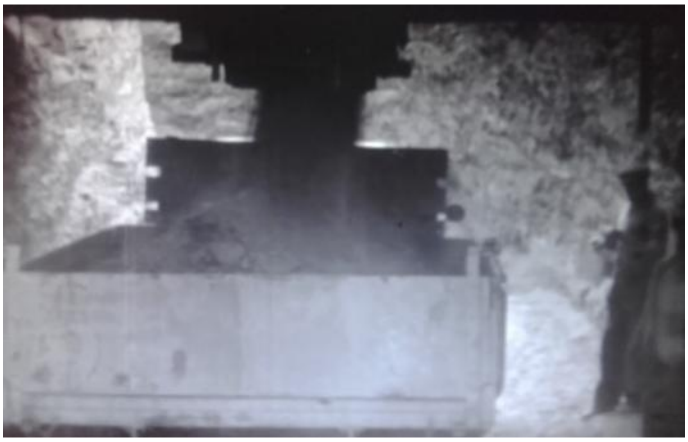
Before the Excavator arrived loading trucks was a more complicated business. Early on it was men and shovels loading drays and trucks. The Steam shovel, used as a crane or a bucket, loaded rocks and material into drays or trucks. The operator of this Cletrac Crawler Tractor overcame the



problem by dragging a scraper over two logs and releasing the load over a truck parked bellow, he probably enjoyed the Adrenalin shot that went with every trip.

On the right, others refined the idea to a ramp and controlled hopper to fill the truck in one pass.

On the left and below, this Bulldozer loads a truck from a chute over one side of a truck ,



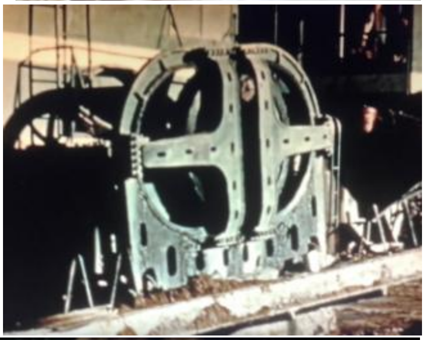



The Cat 30 above demonstrated the need for bigger scrapers when it pulled three. The scraper operator went from machine to machine loaded and unloading them in sequence.

The 30 had also pulled a 3 type ripper to break up the old road bed before the scraper and grader finished the preparation. On the right the Cletrac (K?) was the power for a two man road plant with a ripper/grader and an overnight van. The Crawler Grader, below & right, reduced this to a one man operation for unsealed areas.

WW2 and beyond saw great changes. More machinery was self propelled and there was far less manual shovel work. The front end loader, and later with a back hoe, preceded excavators. Graders took on a standard profile and scrapers became self propelled and powerful.

The Bucyrus Erie walking dragline is seen working on the road from the Hume Highway near Avenal to Ruffy in 1954, as are the other machines on this page, including the Ferguson tractors. Ed



The HARRY FERGUSON TRACTOR CLUB OF AUSTRALIA recently started an innovative project that introduced a team of students to the skills of tractor restoration. The Project started on the floor of their expanded headquarters at the Lake Goldsmith Rally Grounds, and it will continue in stages until it is complete.

One of these weekends will be on the Rally weekend on the 3rd & 4th of November. If you get a chance to drop in you can bring yourself up to date with their progress.

The Club President recorded the start of the project in their club magazine, and it is repeated here with the clubs permission.

YOUNG PEOPLE TO FILL THE RANKS

On August 29th & 30th the HFTCA hosted 13 students from the Alice Miller School at Mt Macedon Victoria as the first step in what is planned to be a club wide project to involve young people in the restoration of Ferguson Tractors. Along the way it is hoped that this hands on experience will educate them about the Ferguson System, teach those involved basic mechanical and restoration skills, and perhaps in the long term attract younger members to the club. The tractors to be used for this project were donated by Neville (Nev) and Jenny Carter, along with a large number of new and used parts that Nev had collected for their restoration. It was this generous gift that got the committee thinking about how to make the best of the tractors with the idea of using them to involve youth in the club eventually coming together.

Prior to the commencement of the workshop, the school had been visited on two occasions. On the first visit I outlined the restoration project being offered to the students and called for volunteers. It says a lot about the school, that of a total of about 150 students, 44 volunteered on the spot. Enthusiasm and interest were high and extremely encouraging. A subsequent visit was made to the school to provide the students with an Occupational Health and Safety Briefing, and to run them through the tools that we would be using on the project. In discussions with the school it was decided that the students would not be using any power tools.

The team involved in putting the project together comprised Vern Finlay, David Ralton, Lindsay A'Vard, Noel Cox, Pauline Wilson and myself. Pauline, who teaches at the Alice Miller School, coordinated the schools input, sorting out dates, supervision, transport and food.

The students would be sleeping overnight in the HFTCA heritage shed at Lake Goldsmith under the supervision of two teachers from the school (Pauline being one of them). David, Vern Lindsay and Noel worked out the timetable for the restoration, and they decided to set up three main work areas and divide the students into groups of three or four, rotating each of the teams through the various stations so that all had a chance to have a go at all of the various tasks involved.

From the outset we were all determined that the students would do all the tasks involved themselves, and members would only provide instruction and Guidance on how to do each task safely and efficiently, This worked very well, and I am delighted to say that we were able to keep to this process for the entire two days.

Vernon had a TEA engine set up on a stand and walked each group

through its strip down explaining how it all worked and giving each student a chance to get stuck in. Once all students had done that, Vernon then assisted David with the strip down process, guiding individual students through the disassembly of various components, such as the steering box, distributor etc.

A pressure washer and cleaning rack were set up outside the shed and Noel guided the students through the initial cvleanup of the tractor using the washer, scrapers, wire brushes and lots of elbow grease. In the shed, David handled the strip down of the tractor in a systematic way with all parts removed placed in labelled containers and taken out to the cleaning station. After cleaning they were set aside for inspection which took place during the last session of the workshop.. The Workshop area used for the process was well equipped with a wide range of tools , stands, jacks etc, generously donated to the club for the project by Lance Maskell and Queensland Tractor Spares. This very practical support to the project was a tremendous help in getting this project of the ground, so once again thank you Lance.

Lindsay had set up a temporary spray booth and paint preparation area in another corner of the shed. His background in panel beating was invaluable as he guided the students through the process of straightening panels, preparing components for paint, and using the spray gun. He set the system up so that, as each student cleaned a part, they followed it through to completion, thus seeing their finished product restored.

The two days were a fantastic experience for the club members involved, we were all in awe of the entire enthusiasm and interest shown by the students throughout the two days.

The only problem we encountered was getting them to take a break, food seemed the only answer to that one. There was a real sense of joy in what they were achieving, and it was infectious. It was great to see their teachers drawn into the process as well.

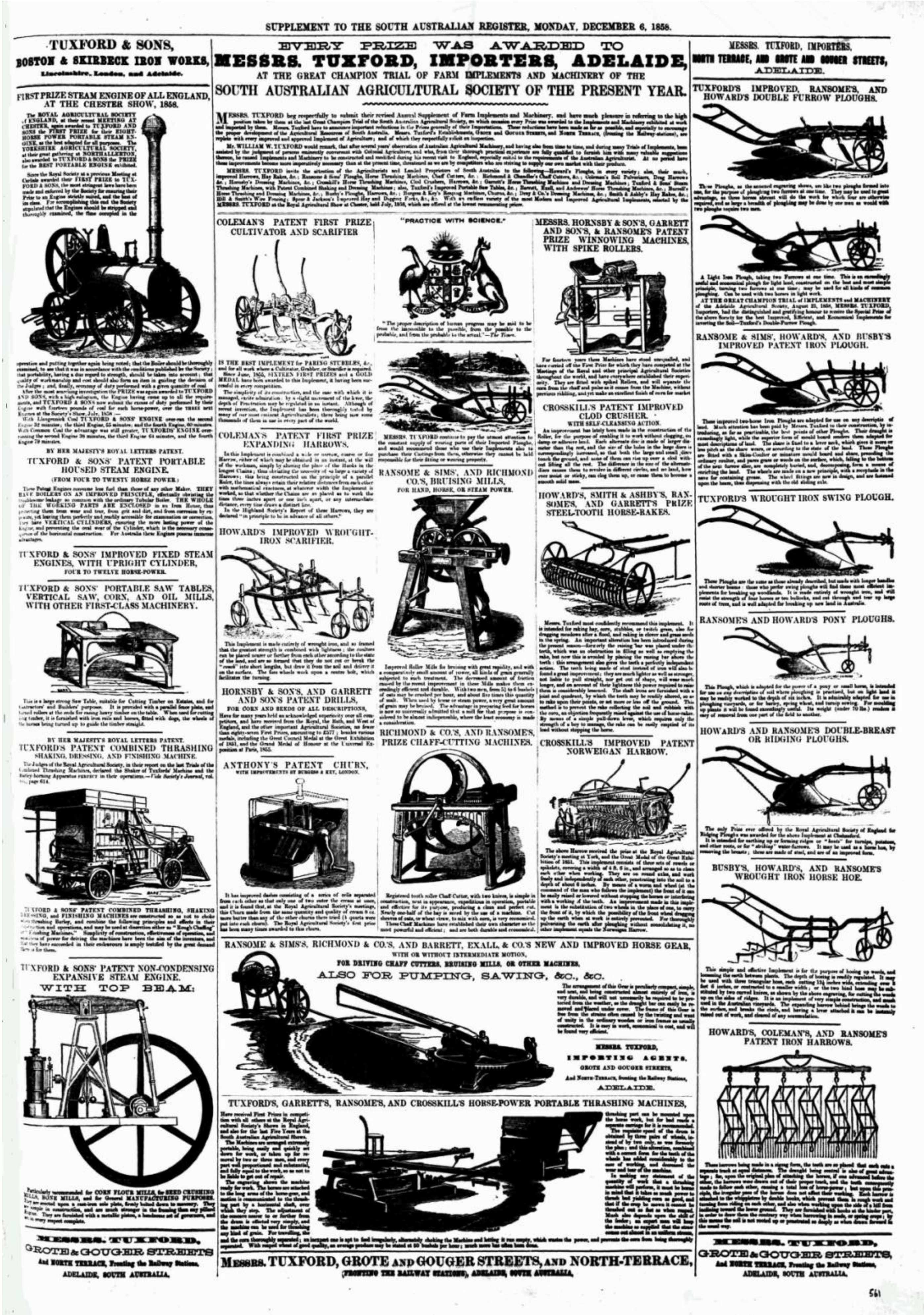
Despite a heavy frost and the temperature dropping to minus five overnight, there were no complaints and after a good breakfast they were all very keen to get cracking. Progress made over the two days far exceeded expectations, and the kids are all keen to come to another workshop to keep working on their tractor. At the conclusion of the workshop it was great to see, on their own initiative, clean and sweep the area, and put away all the tools. As organisers we all felt that these students are a credit to themselves, their parents and the school. They were focused throughout, keenly interested, and clearly all got on very well together. We can't wait to get them back.

At the 111th Rally there was a fine display of Danarm Chainsaws.
Rod Jones is on the helpers end of this massive saw above, while its owner, Stuart Rowe is on the beginners end on the right.

These chain saws trace the origins back to 1941 when the London based Company of TH and J Daniels, who started in 1840, built the first DANARM Chainsaw designed by J. Clubley-Armstrong.
Many of these machines were developed for jungle use by the British Military. These early saws used Villiers engines. The larger machines which were built for two man operation with blades up to 7 feet long. They were powered by motors with a capacity up to 350cc. Smaller machines used 80cc motors.

In 1946 this Danarm Junior was available with blades from 22" to 40" long. At 55lb it was considered light. 1953 saw a pneumatic model on sale, and 1955 saw a household electric model available.

In 1954 Danarm introduced its model DD8F which used a 98cc Villiers engine and was a practical one man machine which sold world wide. In the 1960's Danarm developed its own engines, and branched out into other outdoor products. It ceased manufacture in 1984 and continues as a retail supplier today. If you get a chance to see this collection its worth a look. There is a lot of Chainsaw history there. Ed.



SUPPLEMENT TO THE SOUTH AUSTRALIAN REGISTER, MONDAY, DECEMBER 6, 1858.

TUXFORD & SONS, BOSTON & SKIRBECK IRON WORKS, Lincolnshire, London, and Adelaide.

FIRST PRIZE STEAM ENGINE OF ALL ENGLAND, AT THE CHESTER SHOW, 1858.

EVERY PRIZE WAS AWARDED TO MESSRS. TUXFORD, IMPORTERS, ADELAIDE, AT THE GREAT CHAMPION TRIAL OF FARM IMPLEMENTS AND MACHINERY OF THE SOUTH AUSTRALIAN AGRICULTURAL SOCIETY OF THE PRESENT YEAR.

MESSRS. TUXFORD, IMPORTERS, NORTH TERRACE, AND GROTE AND GOUGER STREETS, ADELAIDE.

TUXFORD'S IMPROVED, RANSOME'S, AND HOWARD'S DOUBLE FURROW PLOUGHS.

COLEMAN'S PATENT FIRST PRIZE CULTIVATOR AND SCARIFIER

"PRACTICE WITH SCIENCE."

MESSRS. HORNSBY & SON'S, GARRETT AND SON'S, & RANSOME'S PATENT PRIZE WINNOWING MACHINES, WITH SPIKE ROLLERS.

RANSOME & SIMS', HOWARD'S, AND BUSBY'S IMPROVED PATENT IRON PLOUGH.

CROSSKILL'S PATENT IMPROVED CLOD CRUSHER. WITH SELF-CLEANSING ACTION.

BY HER MAJESTY'S ROYAL LETTERS PATENT. TUXFORD & SONS' PATENT PORTABLE HOUSED STEAM ENGINE. (FROM FOUR TO TWENTY HORSE POWER.)

COLEMAN'S PATENT FIRST PRIZE EXPANDING HARROWS.

RANSOME & SIMS', AND RICHMOND CO.'S, BRUISING MILLS, FOR HAND, HORSE, OR STEAM POWER.

HOWARD'S, SMITH & ASHBY'S, RANSOME'S, AND GARRETT'S PRIZE STEEL-TOOTH HORSE-RAKES.

TUXFORD'S WROUGHT IRON SWING PLOUGH.

TUXFORD & SONS' IMPROVED FIXED STEAM ENGINES, WITH UPRIGHT CYLINDER, FOUR TO TWELVE HORSE-POWER.

HOWARD'S IMPROVED WROUGHT-IRON SCARIFIER.

TUXFORD & SONS' PORTABLE SAW TABLES, VERTICAL SAW, CORN, AND OIL MILLS, WITH OTHER FIRST-CLASS MACHINERY.

RANSOME'S AND HOWARD'S PONY PLOUGHS.

HORNSBY & SON'S, AND GARRETT AND SON'S PATENT DRILLS, FOR CORN AND SEEDS OF ALL DESCRIPTIONS.

BY HER MAJESTY'S ROYAL LETTERS PATENT. TUXFORD'S PATENT COMBINED THRASHING, SHAKING, DRESSING, AND FINISHING MACHINE.

RICHMOND & CO.'S, AND RANSOME'S, PRIZE CHAFF-CUTTING MACHINES.

CROSSKILL'S IMPROVED PATENT NORWEIGAN HARROW.

HOWARD'S AND RANSOME'S DOUBLE-BREAST OR RIDGING PLOUGHS.

ANTHONY'S PATENT CHURN,

BUSBY'S, HOWARD'S, AND RANSOME'S WROUGHT IRON HORSE HOE.

RANSOME & SIMS'S, RICHMOND & CO.'S, AND BARRETT, EXALL, & CO.'S NEW AND IMPROVED HORSE GEAR, WITH OR WITHOUT INTERMEDIATE MOTION, FOR DRIVING CHAFF CUTTERS, BRUISING MILLS, OR OTHER MACHINES, ALSO FOR PUMPING, SAWING, &c., &c.

TUXFORD & SONS' PATENT NON-CONDENSING EXPANSIVE STEAM ENGINE. WITH TOP BEAM.

MESSRS. TUXFORD, IMPORTING AGENTS, GROTE AND GOUGER STREETS, And North-Terrace, fronting the Railway Station, ADELAIDE.

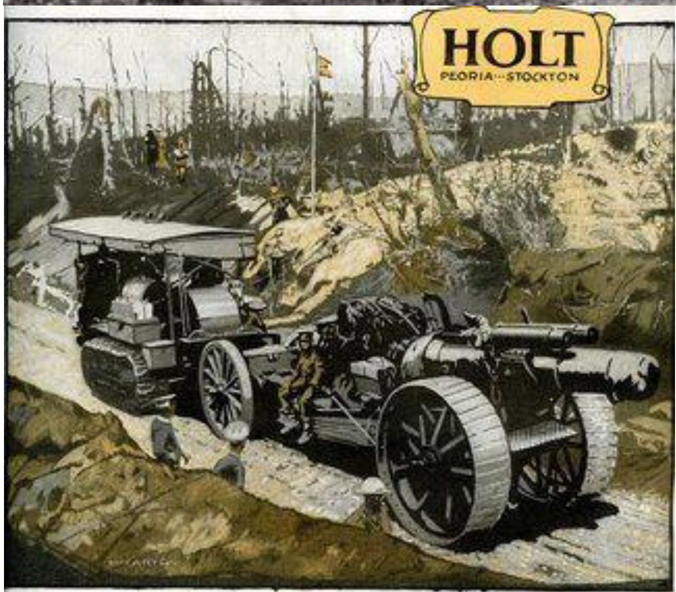
HOWARD'S, COLEMAN'S, AND RANSOME'S PATENT IRON HARROWS.

TUXFORD'S, GARRETT'S, RANSOME'S, AND CROSSKILL'S HORSE-POWER PORTABLE THRASHING MACHINES.

MESSRS. TUXFORD, GROTE & GOUGER STREETS, And NORTH TERRACE, Fronting the Railway Station, ADELAIDE, SOUTH AUSTRALIA.

MESSRS. TUXFORD, GROTE AND GOUGER STREETS, AND NORTH-TERRACE, (FRONTING THE RAILWAY STATION), ADELAIDE, SOUTH AUSTRALIA.

The above TUXFORD advert appeared in the South Australian REGISTER on December 6 1858.



"OVER THERE"—through roadless wastes of mud and sand—over rough ground torn up by shell-fire and covered with countless obstructions—able to travel and climb where no other form of power can go—"CATERPILLAR" Tractors are hauling the Allied heavy guns to firing positions. Since 1914—on every Front from Belgium to Palestine—they have met every call for power and endurance.

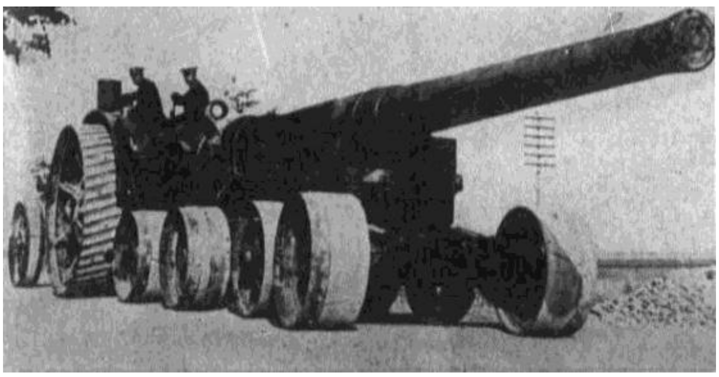
Yet these are the same tractors Holt has been building for years—the product of American genius in times of Peace—and pre-eminent in agriculture and industry in thirty-five different countries.

Inspiration for the great fighting "tanks" is frankly credited by Major-General E. D. Swinton of the British War Cabinet to the "CATERPILLAR" Tractors furnished by Holt to the British Armies.

so that the world may be fed—hauling ore from the mines, logs from the forests—building roads, clearing land—*wherever* dependable power is needed, "CATERPILLAR" Tractors are found.

There is but one "CATERPILLAR"—Holt builds it. The name "CATERPILLAR" is the exclusive Registered Trademark of The Holt Manufacturing Company, Stockton, California, and Peoria, Illinois. In Peace and

The Holt 75 has had a past in road making and the WW1 military. Above it can be seen on road work grading and material transport with 6 trailers behind. On the left, an add by Holt, and the picture the add is based on show it as a gun tractor in WW1, while below a steam traction engine is towing another massive gun barrel. By WW 2 Steam would be the rarity and petrol and diesel would be supreme. The other picture is the Holt 75 recovered and rebuilt by the Williamson Brothers and displayed at the Caterpillar Rally at Lake Goldsmith in 2014. This was a turning point machine.



Lake Goldsmith Tractor Trek Friday Nov 2 2018

Last years ALL MAKES TRACTOR TREK was so popular, it is on again from Lake Goldsmith to the Beaufort Railway Goods Shed Museum for morning Tea with Ron & Linda Harris. A BBQ lunch stop will be held along the way, followed by a return run along a new route to arrive back at Lake Goldsmith around 3.30PM. Tractors will need to be registered, Club plates or VicRoads Permit, and you will need fuel for about 80KM. Safety Vests are advisable. Morning Tea & BBQ lunch are provided, entry fee is $5.00 pp collected on the day. Tractors to assemble at 8.30AM in the Rally Ground car park behind the Fergy Shed. Enquiries to:- Bill Loader 0428 519 231 or Noel Cox 0423 772 461 Noel Cox, Harry Ferguson Tractor Club, Lake Goldsmith Event Co-ordinator.

BEAUFORT WAR MEMORIAL

The War Memorial in Beaufort was unveiled on Good Friday 1927 in memory of the 70 servicemen lost in the 1914-1918 War.

The Servicemen lost in the 1939-1945 War were added later. The memorial includes a light Artillery Field Gun used by the oppos-ing German and Turkish forces in the conflict.
The Gun is a 7.7cm FK96 n/A
These guns were developed from the Krupp FK73 which were upgrad-ed to the 7.7 FK 96 and again later in 1905 to the 7.7 FK96 n/A
The Barrel has the Crown Insignia of Kaiser William II
And the moto "ULTIMA RATIO REGIS" which seems to translates to the Kings Last Argument.