Mutebo-Aspnäs Jernväg

Background and a Brief Account of Facts

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What is a miniature railway and what is live steam?

Miniature railways are common in the Great Britain. Also, there are several in Switzerland, Germany, Holland and in the US. In most other countries they are rare. In Sweden, three such railways are open to the general public, viz. “Sandlidsbanan” outside Borås; one at the State Railway Museum in Gävle; and this one.

Miniature railways are an old phenomenon. It started as a curiosity in the end of the nineteenth century. Miniature railways did also find some local use for goods transports. Originally the gauge was 15” (381 mm) allowing 50 and more passengers. Some of these original railways still operate.

In the twentieth century smaller scale model trains appeared. In Sweden we are all familiar with electric model trains in gauge H0, i.e. in the scale 1:87. However, the British hobby of “Model Engineering” did not spread much in Sweden. This was leisure activity amongst thousands. Men, with a variety of professions like engineers, mechanics, lawyers, doctors, and the like, constructed a mechanical amateur workshop in their home, with a small lathe and drilling machine. There they spent the long winter hours before the advent of television. The products were models of steam engines – typically in scales 1:16 or 1:12.

The prototype engines could be locomotives, ship engines, steam tractors, or stationary engines. The models were true miniatures of the real thing, operating on steam, fired with coal and strong – not toys. Such models are called live steam – “echtdampf” in German. Mainly in the United Kingdom, at the zenith of the hobby, there was some hundred model engineering clubs. Many still exist and they operate their own train tracks for running the model engines. Standard gauge models loco in the scale 1:12 runs on 5” (127 mm) gauge track and may weigh 100 kg.

It is not clear whether the model engineering hobby is a growing or diminishing movement. The hobby has evolved and changed form. Forty years ago the live steam models always were hand-made out of scrap metal and iron and bronze sand castings to be machined by the model engineer. This took a very long time – 2000 hours or even more. Just a few people have that time (or patience) today. With modern CNC machines, beautiful machining can be done to a relatively small cost. Thus today many of these models can be bought as kits for self assembly.

Another trend today is that miniature railways, i.e. railways with very large scale models used for carrying real passengers, are becoming common. Today, these railways are built in gauges 7 ¼” (184 mm - this gauge is scale 1:8 for standard gauge and is the one used at Mutebo-Aspnäs Järnväg), 10 ¼”, 12 ¼”, 15” and 18”. The locomotives for these railways will be large and weigh from hundred kilos to several tons. Apart from CNC machining, there are today improved techniques for quality welding and for precision cutting of steel plate. Exploiting the new techniques in boiler manufacturing for instance, the boiler will be just as functional and safe, but much faster to produce than an old riveted boiler. In all, it is possible to build large miniature engines with much less effort than before.

Nostalgia activities are probably a useful thing helping people to put the modern society in a bigger context. One should have the deepest possible respect for the enormous technical and social development which has occurred in today’s society. However modern technology is scaringly streamlined and efficient and provides little understanding of its internal workings. Experiencing steam engines and former days transportation technology helps in giving perspective to its modern counterparts and hopefully to uphold the interest in taking these even further. It is thus hoped that a visit to Mutebo-Aspnäs Jernväg could be of some little benefit and joy in these respects for children of all ages.

My history

When 12 years old, I came across the model engineering hobby in the form of a book “Miniature Locomotive Construction” by Martin Evans. Most of the English I did not understand, but I grew fascinated by the possibility of making engine miniatures. Plans for quitting school and training to become an instrument maker were stopped by my parents. Later, as a university student, I equipped a spare room in my grandmother’s flat in Stockholm with a small lathe and milling machine and started building a 7 ¼” gauge locomotive in the little spare time I had. After 20 years a friend eventually completed it, and I ran it on the “Sandlidsbanan” outside Borås. I bought a minibus to facilitate transport of the engine in order to use this very nice track layout. However, it was a lot of effort to load the train into the bus and go off to the track. The idea emerged that I would build my own miniature railway.

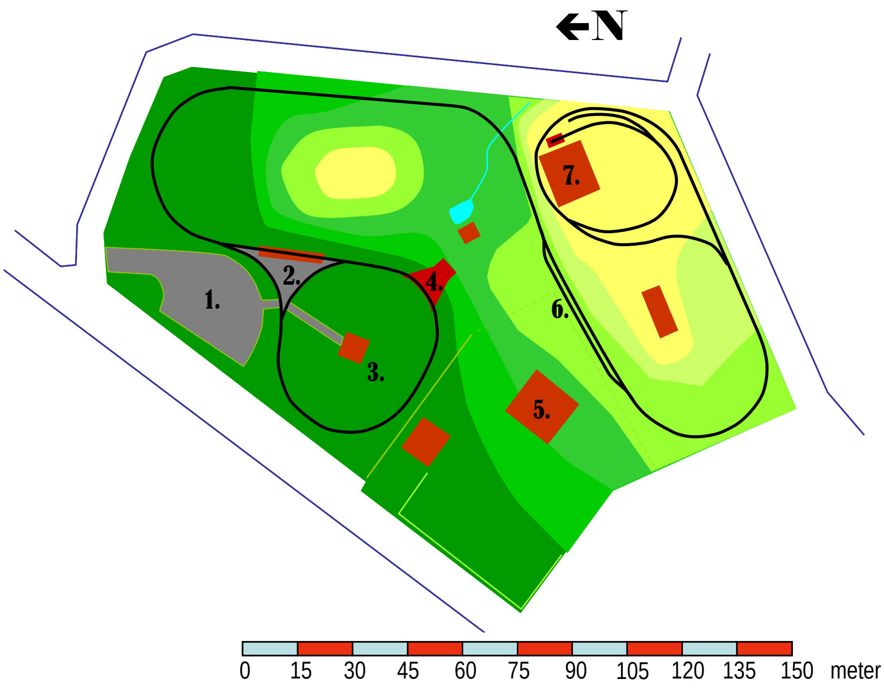


Figure 1: Railway Layout: 1. Visitor's Parking; 2 Main Terminus; 3. Café; 4. Theatre; 5. Living House; 6. Meeting Loop "Mutebo Nedre"; 7. Turning Loop "Mutebo Öfvre", with workshop, engine shed and sidings.

Thus, I and my wife Monica started to look for a house in the countryside, sitting in a piece of land suitable for a railway project.

In 1997, in the rush of being the first to get the present house, the inspection of the surroundings had to be a quick one. A later more careful survey revealed elevations making the subsequent construction more complex than appreciated. Also the land premises had to be extended by acquiring an adjoining farm field. By this addition our land lot has a total area of about 10 000 sqm.

For me personally, a railway for your exclusive individual use would not be fun in the long run. There must be some basic reason which compels you to all labour of keeping the railway in good shape year after year. One such can be forming a club as is done in the UK. However I and my wife were appealed by "commercial" running. We wanted to keep the railway for the general public with the sensation that people actually are paying for what we offer. I run the railway and my wife a small café adjoining. We have both much enjoyed this combined concept, having received 18000 guests up to the present time, which is 7 seasons of running 3 hours in Saturdays and Sundays during June to August. All visitors have been a true joy to meet; many have become regulars visiting us over and over again, and some our dear friends.

Layout and operation

The farmer selling the adjoining field knew a small digging enterprise run spare time by a fire fighter and his son. He also knew about a small family enterprise running a gravel pit. The digging firm was closing down so for them to take on making the earth works, construction had to start right away, which was in 1997. So moving into the house was mixed with land survey, planning and the railway construction.

Laying out the railway a number of things had to be considered. There should be a terminus with the adjoining café, and there should parking places for the public. The layout had to cope with the height differences of around 7 meters from one end of our premises to the other. Also the living house should be separated from railway layout in order that the railway traffic should not intrude on the family private life. Moreover there had to be a supplement of suitable water for steam operation. There had to be a workshop and a storing place for the rolling stock and also arrangement for lifting trains into the workshop for storage and service.

The layout is showed in Figure 1. Basically our land lot is divided into two relatively level plateaus with a slope in between. The bottom plateau is the former farm field where the terminus café and parking place now is. Here the railway makes one complete loop. It then winds on a bank to the higher plateau where there is another turning loop. Here there is a building adapted as a workshop and rolling stock storage. There are also service tracks leading to ash pit, engine shed, sidings and a traverse crane by which engines and coaches are shifted into the workshop and additional stables.

Midpoint on the track there is a passing loop.

The turning loops allows for continuous running while at the same time a complete tour uses part of the track two times in different directions giving variation to the tour in spite of a limited track length. The length of the railway excluding sidings is 450 m, while a complete tour is 700 m. Due to the fairly slow process of climbing the incline, a tour takes a quarter of hour. The passing loop makes two-train operation quite interesting, with the down train holding and letting the up train pass at this spot. Supporting two-train operation there is semaphore signal system based on the line blocking principle. It will be described in more detail later on.

The overall height variation to be encompassed by the railway is 6.1 meter. In view of the limited track length this difference is significant. To reduce gradients the entire lower loop is elevated to a constant level by extensive banking. The remaining height to the upper loop is thereby 5 meters. The turning loop curves have

Figure 2a: Construction of passing loop showing several elements of track construction. Before laying into place, the track is preassembled with only one rail attached. It is thus still highly flexible and can be sprung to its proper location (with the proper bends) and weighted down with stones as required. Reference stake pins are then located at some offset besides the track. In the picture, also note stop signal showing clear and signal box for driver control of signals.

15 meters turning radius, while curves on the open stretches have a slightly larger radius. For the 15 meter curves the gradient is relaxed by 1% and for the curves on the open stretches by 0.9%. The gradient on the straight stretches thereby becomes be 2.4% while the gradient is 1.4% and 1.5% respectively on curved stretches.

Some miniature railways are built with aluminium rails. Mutebo-Aspnäs Jernväg uses steel rather aiming at a better friction on the steep gradients.

Going uphill with full load is exciting to both the driver and the passengers. Normal procedure is to start the train making the lower loop first, thus encircling the café. The train proceeds slowly, whistling several times, making a show for people sitting in the café. The turn also provides some time for the driver to watch that boiler pressure is ample and stable for the coming severe uphill work. Several passengers do not understand where the track is heading. They become happily surprised when train approaching the terminus suddenly deviates, the throttle is opened up and the engine really starts working. Having made the first careful turn after the loop, the engine is notched up, speed increases and the sound of the engine pounding hard is familiar to everyone from child memories, the movies or television. The constant climbing is thrilling, the

Figure 2b: Construction of passing loop showing several elements of track construction. With the stake pins of the foregoing figure providing reference, the track is removed and a shallow ditch in the track position dug, so the track can be sunk into the bank. Only then the second rail is attached. The photo shows the new track in this situation, before the final filling of ballast. A fiber cloth is present at the bottom of the ditch but cannot be seen in the photo. The new point has not yet been provided with its throw mechanism.

more so since the train largely run on banks, where you can look down to see how you gain height. An interesting psychological phenomenon is that people do not sense that the railway is so short. Quite often they believe they have travelled for two kilometres or more.

During the first years wheel slip due to wet rails was a concern. At that time the only useful motive power was the 4-6-0 passenger loco “Stanier “Black Five”. In dry weather, train weights of 1200 kilos (excluding engine and driver) were possible. With the scale coaches this means trains with around 20 passengers, mixed children and adults, or a dozen adult passengers.

In wet weather my experience is that friction for Black Five is reduced so that just one third of this load can be taken when rails are wet. This is little more than the weight of the engine plus driver. It was originally impossible to run Black Five with even with the smallest passenger load in rainy weather. Installing an electric booster bogie on one of the coaches was an innovation which improved things greatly. Adhesion on the bogie increases with increased passenger load and the modern electronic speed provides the electric motors with excellent characteristics to minimize wheel slip.

The non-scale Roanoke petrol locomotive is also prune to wheel slipping, but using sand it is a functional alternative to the Black Five combined with the electric booster. The load capacity for either alternative is maybe 600 - 800 kilos when weather is wet.

The non-scale Exmoor steam locomotive is much heavier than the other engines. The problem of wheel slipping with this engine is small. On occasions of heavy rain the engine can pull three non-scale coaches containing 16 people viz. a train of 1300 kilos without sanding.

For full-size railways, friction is reduced by the wetting of the rails, but only by – say – 20%. The difference in friction for models and full-size practice is due to the difference in the pressure excised by the wheels on the rails. For light models, this pressure is evidently not sufficient to overcome the viscosity of water - the water film remains intact preventing direct contact.

Rainwater is used for the boilers, adopting the 100 sqm workshop roof to collect it. There is a 3000-litre water tank in the shadow on the north side of the building. A 0.7 m diameter cone of fine wire mesh (the same material as used in the loco tank filters) clad inside by a synthetic fibre blanket filters the water. Experience is that the surface of the roof is sufficient for all demands. Today consumption is 300 litres a week (including watering of some plants), which requires an average rainfall of 3 mm a week.

There is a trestle crane over the railway by which scale engines can be lifted. The crane can move sideways on its own pair of rails crossing the railway track. There is a bridge extension to the elevated workshop track made of aluminium and thus easy to lift into place. Having shifted the trestle into place, the bridge is stuck in under it, attached to workshop track; the engine is lowered onto it and rolled into the workshop for storage and maintenance. It is 1 ½ hours of work oiling the engine, lifting it out of the workshop and onto the track and raising steam. There is another 1 ½ hours of work of cleaning the engine and lifting it into the workshop after running.

On the same crane rails there is an additional low slung trolley with 7 ¼” rails forming a cradle that tips to meet the outside tracks or those on the floor of the additional shed. The trolley allows the Roanoke engine and the non-scale coaches to be brought outside in 10 minutes. The engine shed is a very small but insulated and heated building. The Exmoor steam loco can roll into it without lifting and it allows storage all year around.

Track construction

In contrast to the UK and the continent, Swedish annual climate changes must be taken into account in miniature railway construction. Swedish summers involve days or even extended periods as hot as in southern Europe. Autumns may include massive rainfall followed by freezing, leading to extensive ground frost. The effect of ground frost on roads in springtime is well known. The same effect can ruin the miniature railway track unless appropriate precautions are taken.

To minimize the effect of ground frost, drainage is very important. For the railway, large quantities of pure sand were available. The banks are built around a core of this sand with additional drainage piping put in. To obtain a non-eroding surface a 0.2-0.3 m layer of crushed stone is put on top of the sand. A vibrator was used extensively to pack all material. It has not been necessary to remove the original vegetation soil layer before putting on the sand. On the bank slopes a grass mixture intended for the sterile conditions of road banks was sowed. This mixture was originally obtained from the technical department of the Swedish Road Department. Later similar seed bought in a garden shop did not yield the same good results. All in all the banks have remained remarkably stable during the eight years since they were built.

Figure 3: The stop (red wing) and distant (yellow wing) semaphore signals are distantly operated by computer controlled electromechanical servos. The plastic tubing for communication and illumination power cables is plainly seen. In the photo the engine is Brasken pulling empty coaches complete with their smoke protecting canopies.

Figure 4: Close up of semaphore servo mechanism. The signal wing is connected to the counterweight arm, which in turn is lifted or lowered by a DC servo motor. The motor, its reduction gear and winding drum is housed in a watertight box and pulls the orange string. The rotation of the motor is controlled by end position microswitches. Microswitch responses and DC motor current are checked and controlled by the signal box computer via 4-pole electrical connection to the signal.

Standard sleepers are cut to from best quality larch or oak in 400 mm lengths, with a rectangular or trapezoidal section 35 - 50 mm wide and 50 mm high. No impregnating agent for the sleepers is used since drinking water is collected from a well in the close vicinity of the track. In fact, it is claimed that non-impregnating larch will age better than pressure impregnated fir, the latter being the customary type of wood for outdoor construction in Sweden. Oak will survive even better than larch. The majority of larch sleepers has been out for eight years, most still in good shape.

The steel rails are from the company “Cromar White” and 26 mm high. They are attached to the sleepers with the type of screws normally used for sheet metal roofing. These screws are equipped with a metal and a rubber washer to water seal the hole made in the roof sheeting. The screws are almost ideal to hold the rail flange to the sleeper. The screws are self drilling and in spite of a good non-corrosive coating quite cheap to buy in quantities. The one draw back is that they are hardened (to be able to go through roof sheets) and thus a bit brittle. Probably due to ground frost, some screws have been found broken when maintaining the track. For this reason the original screws are currently replaced by heavier non hardened screws with the same type of head. The one draw back with the new type of screw is that sleepers have to be pre-drilled.

The major earth works was completed in the summer 1997, and were allowed to settle during winter for the actual rail laying in the summer 1998. During the winter the required length of track was prefabricated in 4 m straight track sections in a jig providing a 125 mm gap between sleepers. 8 mm holes were drilled in both ends for the rail joints. The section was built to a gauge of 184 mm for the essentially straight stretches and with a gauge 185 mm for the 15 m radius curves.

The actual track bed rests on plastic or glass fibre blanket sheets preventing seed to root itself down into the ground. Track laying consisted of removing one of the rails of the prefabricated track sections so that continuous lengths of track could be formed to the required shape, holding the track temporarily in place by stones while attaching the other rail. M5 screws were used for the rail joints, which were securely tightened. With both rails attached the shape of the track became given and rigid. Rail joints were “staggered” so that the rails on one side were joined at the approximate midpoint between the joints on the other side. Whenever a suitable stretch of track had been completed, it was ballasted with 8x12 mm macadam.

Even the 15 m radius curves could be constructed in this way and smooth bends formed without kinks, without any pre-bending of the rails. However as time went by and in particular during the first winter, kinks arose at some joints in the curved rail sections. A tool has therefore been made in the form of two heavy section steel levers, which are clamped to the rails about 150 mm apart. A threaded M12 bolt forces the levers apart or to each other thus bending the 150 mm section of the rail. With this tool the rail in the vicinity of each joint can be pre-bent to the required radius to remove the kink and restore the smoothness of the curve. Having used this tool for maybe 25% of the joints in the curved sections the track has by now settled to maintain smoothness with very little further maintenance.

Another climate problem in the form of rail wandering was recognised. What happened was a gradual sidewise shift of track position during extended periods of hot weather. Letting this process develop the intended curvature of track changed so that some parts of the track straightened while curvature grew sharper in between the straightening sections. The increasing curvature eventually developed into real kinks. A remedy has been to put in 50 mm section oak sleepers wherever the side movement is large. The oaks sleepers are drilled to let 12 mm steels rods maybe 800 mm long be driven down through these into the ground. This will lock rail movement. Maybe twenty such sleepers have been put in at critical places and again this seems to have stabilised rail the movement so that rail wandering now is a small problem.

Initial points were bought ready-made from “Cromar-White”. Later points were copied using the ready made ones as a template. Point thrower mechanism are made in the workshop. The initial points were of aluminium for reasons of cost. Aluminium is however a weak link to the risk of wheel slipping. The later points for the recently built passing loop and sidings are all made of steel.

Signals

The railway is equipped with a line-blocking semaphore signal system. Semaphores were a forerunner to present day light-only signals. The semaphore outline is British.

Semaphores with red wings are stop signals, which means that stop indication must be obeyed by the train in front of the signal. Semaphores with yellow wings are distant signal, warning the driver that the nest stop signal ahead displays stop indication. The diamond on the signals, indicate on the prototype signal that “Rule 55” applies, viz. that a low voltage system is in place sensing whether there are trains on the track within the line block or not

Signals are located so as to provide outgoing (in contrast to the approaching) traffic control. Thus the driver is told by the stop signal to remain in one of the three loops in which trains may meet. The driver remains there until he is given a clear sign to go. This occurs by having at either end of a block one push button for request to enter and one push button for the clear declaration. For each loop there is one signal box containing the push buttons for the lines adjacent to the loop. Typically the clear declaration and the request to leave are conducted at signal boxes at opposite ends end of the block. There is one master and two slave boxes, where the master box obtains status, carries out the logic, and provides instruction to either slave box.

The signals were manual, as delivered by their manufacturer “Scaleway Signals” in Bristol. They have subsequently been motorized by DC servo motors, actuating the semaphore mechanics. Servo motion control is accomplished by the signal boxes of each loop.

The required cabling consists of 240 V mains and computer cables in between the signal boxes - these are held together in an underground plastic tube. Between the signal boxes and the semaphores there are low current servo motor cables and 24 V cables for signal lamps hold together in a plastic tube. The 240 V and 24 V cables are of a heavy section, thus shielding the computer cables from any ground current in connection with lightning.

Figure 5: The Stanier Black Five and the LMS scale coaches pulling out of the terminus station on a cold autumn day (seen by the amount of steam condensation). The first coach is equipped with an electric motor booster to support operation in rainy weather.

The coaches

There are two types of coaches – scale and non-scale ones.

The scale coaches were manufactured by Rob Hall in England. Their bodies are made of glass reinforced epoxy. Each coach has one braked and one non-braked bogie. As is the case for the full-size counterparts of the coaches breaking is by means of vacuum and is remotely controlled from the locomotive by a pipe system running along the train. The vacuum brakes have the property that the coaches only will roll freely as there is a vacuum in the system. This means that if the train should split up, e.g. if a coupling should loosen, the vacuum is lost and the train automatically breaks.

The coaches resemble those of LMS, i.e. “The London Midland and Scotland Railway”. They are typically British with their curved sides and division into compartment designs, which really are artefacts from the time of horse carriages. Each compartment is only accessible by its own separate entrance while the conductor has his place in either of the train ends where he can supervise the train from the “bow window”. The wine red colour was a characteristic of LMS.

In Sweden, the state intervened in the building of railways already from the start in the mid 1800. Apart from the state railway “Statens Järnvägar” there was private railways but generally these were quite small. Rolling stock and locomotives were generally built by specialised Swedish private companies, though in the early stages of Swedish railway development they were imported from Britain or Germany.

In contrast, as late as in the thirties, railway operation in Britain was still carried out by a number of individual companies. Only after the Second World War these were united into a single state company – “British Rail”. Each company had their own colour scheme to the coaches, as they had their own design preferences for locomotives”. The large companies like LMS had their own plants (Doncaster Locomotive Works in the case of LMS) providing for the supply of locomotives. The non-scale coaches are manufactured by Scaleway Signals, though they have later been equipped with a canopy. The canopy is not so much for preventing rain, as for preventing soot to fall on the passengers when using steam.

The coach design follows original miniature railway practice and is reminiscent of typical designs from the early twentieth century. Just as the scale coaches, they have one bogie braked by vacuum. The couplings are of the central buffer type, and are similar to those of most Swedish narrow gauge railways.

The weight of the scale coaches is 50 kg and the non-scale coaches 180 kg.

Figure 6: Close up of the Black Five cabin. Seen are the steam and vacuum (painted red) brake controls and the gauges showing degree of steam pressure and vacuum. The slit in the fire doors reveals the glow of the fire. In the tender lies the electric booster control.

Both types of coaches were frequently derailing as originally delivered. It turned out that the coaches were very sensitive to any sideways irregularities in track tilt.

In both cases the coach body rested with its full weight on rollers on top of the bogies. This design has been modified by also installing a central spring adjusted to carry nearly the full weight of the empty coach. By this modification weight of the coach body is fully exploited to increase the bias load on each wheel (rather than having the coach body resting on resting either of the rollers and thus pressing on the bogie wheels on just one side).

As it turned out, the modification has greatly increased the reliability of the coaches and made derailments rare for the scale coaches. The non-scale coaches still derailed with heavy loads. A mathematical analysis of the spring suspension was conducted the summer 2007. It revealed that the original bogie main springs were too light and located too far out from the bogie centre to be functional even when track tilt irregularities were small. A heavy load could result in near-zero rail loads on one side of the bogie, thus making derailment imminent.

The non-scale coach bogies have all been modified according to the analysis. The problem of derailments now seems to be solved.

The engines

There are in all four completed engines and one in an advanced stage of manufacture. Again they can be divided into scale and non-scale designs.

The three scale locos are accurate and fully working miniatures to the scale 1:8 of full-size steam locomotives. All three models follow British locomotive practise, though they are built in Sweden. The reason for slavishly following British practice is that in the English tradition of model engineering, also for these large scale locomotives there are published designs. In view of the limited model engineering experience in Sweden, the three engines follow closely these designs.

In spite of their smallness, the engines are surprisingly strong. The “tractive effort” of the “Black Five” is 500 N. for instance. The speed is not so great – 10 km/h - so the developed power is just 2 HP. The thermal efficiency is about 3 %, which means that the heat power developed by the burning coal is 50 kW – enough for the heating of two ordinary villas in Sweden at wintertime! The gradients of the railway restrict train weights to 1.5 tons. On level ground the weight can of course be much greater.

The other completed scale engine “Jonas Bagge” is about 1/3 as strong as Black Five. The still incomplete third scale engine “Paddington”, though considerably shorter, has essentially the same cylinder dimensions and weights on the driving wheels as "Black Five". It should therefore be able to pull just as well as "Black Five", though at a slower speed (the boiler and thus its steam generating capacity is smaller).

Steam pressure is 7 bar for Black Five and Jonas Bagge and 8 bar for Paddington. In all models the steam is superheated, increasing the temperature from 170° C in the boiler to maybe 250° C reaching the cylinders. At full power, the "Black Five" consumes 1 kg. of coal and 7 liter of water per kilometer. High grade coal, such as "Welsh Steam Coal" or Antracit, is called for. Because evaporation is so large the water must be free from lime and other mineral deposits, so rainwater is used.

Stanier Black Five: The model was built by Bengt Jansson between 1975 – 1980. Construction time amounted to 5500 hours. For several years the engine ran at the "Sandlidsbanan" in Borås, carrying 13 000 passengers and totalling a distance of 1 000 km. A new boiler was fitted 1996. The engine was brought to Mutebo-Aspnäs Jernväg in 1998 after which the vacuum brake system was added. Between 1999 and 2006, it was responsible for all running at Mutebo-Aspnäs Jernväg. This means running 900 km carrying about 9000 people.

The original Black Five was one of the most common and successful of all British locomotive types. It was designed by Sir William Stanier at the LMS in 1934. 842 engines of this type were produced, many which stayed in service until the close down of the steam era in England in 1968. The type could handle most jobs from goods trains to fast passenger traffic operating at speeds up to 90 mph (145 km/h).

William Stanier belonged to the last generation of steam locomotive developers. Others were Sir Nigel Gresley in England and André Chapelon in France. Using new materials and scientific design methods they produced steam locomotives during the thirties capable of operating at speeds of 160 km/h and more. Development came to a halt with the outbreak of the Second World War. After the Second World War there was an immense demand for expedient ways of performing the enormous transportation task connected with regaining what had been destroyed by the war. That meant a massive introduction of diesel locomotives and the end to the steam locomotive development. Still 12 "Black Fives" are preserved at various museums and veteran railways.

The early electrification in Sweden (starting in earnest already in the twenties) meant that Sweden did not participate in this late development of "high end" steam. Nor was the permanent way in Sweden of a standard, which permitted high

Figure 7: The Stanier Black Five and Jonas Bagge standing side by side in the workshop. Note the saddle tank and the small boiler of Jonas Bagge.

speed running as in England, France or Germany.

Paddington: Dick Larsson started upon this still incomplete model. It was acquired to the Mutebo-Aspnäs Jernväg in 1999.Orginally it was intended to relieve “Black Five” handling passengers to the railway. Later on this plan had to be reconsidered. Scale models wear to rapidly and will in not so many years be run down by the intense use.

“Paddington” is a model of the 1500 class of locomotives designed for the needs of GWR in 1948. While Black Five is a tender engine, which carries its water in separate wagon, coupled to the locomotive, Paddington is a tank engine, which carries its water and coal in tanks onboard the locomotive. This was the preferred arrangement for engines, which had to run in the backward directions just as often as in the forward. However, these engines were less suitable for long distance trains which required ample amounts of both coal and water.

Great Western Railway – GWR – was one of the big British private railways, apart from LMS, before nationalisation. It provided for the west and northwest train services from London reaching Cornwall and Wales. Its terminus in London was Paddington station. The 1500 class was designed for heavy shunting duties. However, the shunting role

Figure 8: The 1500 class engine model. The relatively large dimensions of boiler and cylinders are evident.

had already been given to diesel locomotives as the class emerged out of Great Western Swindon Locomotive Works in 1949. In effect this meant that production was terminated after only 12 engines of the class had been built. The engines were given the job of pulling empty coaches between the depot and Paddington station. All were withdrawn from this duty by 1963. Several were sold and found work for a few more years on industrial sidings. One engine of the class remains and is still in working order on Severn Valley Railway.

Like "Black Five", the 1500 class is an example of "modern" steam locomotive practise. A common feature is the tapered "Belpaire" boiler (the name is from the Belgian inventor Alfred Belpaire) Characterised by a conical boiler barrel ending in a firebox as large as in consistent with the loading gauge. This type of boiler was held in high esteem by GWR as providing superior performance over the cylindrical locomotive boiler used in Sweden for instance. This high regard may have been well founded, since the shape was inherited in most of the very late designs for steam locomotives in Britain, performance evidently outweighing the considerably more difficult manufacturing of the conical Belpaire boiler.

Jonas Bagge: It was mentioned in the introduction that the railway started with the making of the chassis for this little model some thirty years ago. The boiler was

Figure 9: For comparison. A full-size 1500 class engines now preserved at the Severn Valley Railway.

made in England. After many years in an unfinished stage, Bengt Jansson completed the model in 1996. Overall time for its construction was 2500 hours.

The British naval engineer Ken Swan designed this model. It is not an exact replica of any specific full-size engine, though it adheres to the design used by “Stephenson and Hawtorn Locomotive Company” at the end of the nineteenth century for light industrial tank locomotives, so in this it is also a scale model. “Stephenson and Hawthorn”, “Beyer and Peacock” and several other British locomotive manufactures operated beside the locomotive plants belonging to the big private mainline railways in Britain. These other locomotive manufactures thrived on export business, shipping their locomotive to all over the world – not least the British colonies. Also they produced small engines for domestic use on the small private railways and for industrial use.

A characteristic feature of Jonas Bagge is the saddle tank riding on top of the boiler. The saddle tank is very common feature of older industrial locomotives. This was allowable since boilers still were quite diminutive – coffee-pots they were called later. In contrast the 1500 class exploits a so-called Pannier-tank arrangement, allowing for boiler diameters just as large as for Black Five. There is one striking anachronisms concerning Jonas Bagge – superheater was not invented when this type of locomotive was made. Superheating is a sacrifice to well-working model.

The name Jonas Bagge derives from one of the early Swedish scholars in mechanical engineering, who was active in the mid-nineteenth century in Sweden.

Honken: As said, over the years it has become evident that models in scale 1:8 are too fragile for commercial use. They will certainly do the job during favourable circumstances. However in rain they slip, and wear from that. They become dirty, possibly rusty and require a very careful and extensive maintenance to keep even reasonably in shape. As a remedy the petrol locomotive Honken was bought for the season 2004. Honken is made by the company “Roanoke” (Dave Carder) in the tiny village of Bratton Flemming in Devonshire. The company produces this type of engine in fairly large numbers – they are used as back up engines on many miniature railways.

The engine has an outline of industrial narrow gauge diesel engine. Actually the motor is a 9 HP industrial petrol engine driving the wheels via a hydrostatic gear box. The engine weights about 300 kg, providing a tractive effort slightly better than the Black Five.

Brasken: The inadequacy of scale 1:8 engines has been noted by several miniature railway operators. An innovation was made when Roger Marsh, several decades ago, came up with steam engines that were not models but more very small real narrow gauge steam locos taking the narrow gauge practise to the extreme of only 184 mm gauge. Actually also in this context there is an old tradition started by Sir Arthur Heywood of designing not models but practical steam locos for 15” gauge.

This practise has been followed by Trevor Stirland, who together with his family operates the company “Exmoor Steam Railway” also located in the little village Bratton Flemming. Brasken is an example of this “Exmoor type” steam loco. It is designed to be able cope with the tasks of a commercial miniature railway running, requiring performance in all types of weather, a reasonably comfortable riding for the driver, simple maintenance and so on. In contrast to the scale locos it burns full-size coal lumps. Just as Honken, Brasken is equipped with vacuum equipment for breaking of the coaches.

Though not a scale model, Brasken reminds in general layout very much of two feet narrow gauge steam practice, in particular in its British version. The bright colours, the lining and the brass (hopefully polished) are all examples of that. So are the tall chimney and steam dome and the outside frames with exterior cranks.

Brasken is about three times stronger than any of the other locos. It weighs in service about 900 kg.

Figure 10: Honken with an appropriate load of passengers.

The future

What about the future of Mutebo-Aspnäs Järnväg? What are the possibilities of expansion?

As for the track itself it can not be largely modified within the current land lot. One could of course speculate what could be done if boundaries were of no hindrance. For instance the track could be expanded to the village “Skeda Udde”. Still it is not clear what could be gained by that. Would the pleasure of going with the train increase by this to such an extent that ticket price could be raised to cover the investment and maintenance of the longer railway? This seems debatable to say the least.

Another expansion is by increasing train length. Presently, four coaches are the maximum length simply because this is the number of coaches available for either the scale or non-scale trains. However, given more coaches, the strength of Brasken allows train lengths to be increased. There is however an increased risk for accidents in doing so. With longer trains the driver can not view the train and the passengers as well. Also if a long train would derail inertia would be very large and there is a risk of coaches piling up on top of each other with injuries following. Even presently Brasken with four coaches and 20 adults amounts to an overall weight of 3200 kg.

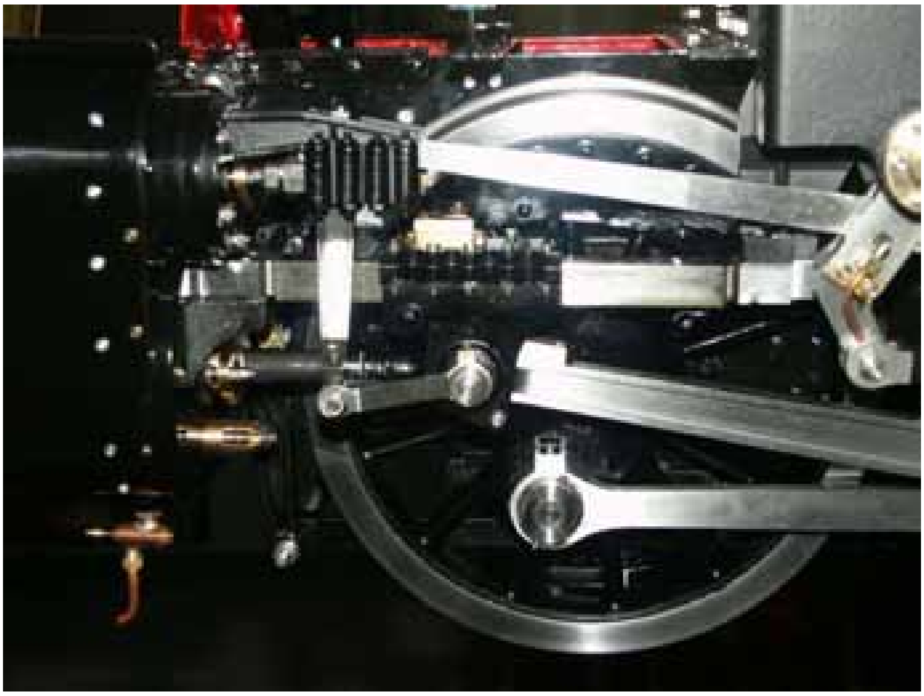
Another type of expansion is by increasing train density. This is a true possibility – it is “simply” more a problem of having a sufficient number of drivers. Willing,

Figure 11: Brasken being cleaned outside its shed. Note the arrangement with outside frames and cranks. The valve gear is of Marshall type, also characteristic for well-known Ornstein and Koppel narrow gauge engines. It has the advantage of avoiding the complexity of an expansion link, present in most other valve gears.

sufficiently skilled and reliable drivers are however few and rare.

The best way forward is considered to be to keep to the established and successful practises but to continue to introduce novelties in the operation, like new engines and coaches With an increasing variation in what is offered new and old customers alike would come and visit us and a few would no doubt like to function as volunteers keeping the railway active and eventful.

Plans for the future involve new non-scale coaches of a luxurious and practical design, as well as a new engine. The choice of engine is a consequence of both practical experiences, e.g. a wish to avoid the fragility of scale 1:8 models, and the popularity the scale models has with visitors. Then a good compromise would be scale models of large narrow gauge engines. In the scale 1:5 or so a large narrow gauge engine is very massive and as strong as Brasken, but certainly so much more reminiscent of full-size steam practice. At the same time it just so much more robust in its general dimensions that it’s a practical proposition for the commercial running.



Close-up of Paddington's motion gives a clear impression of the near-scale proportions of the model.

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July 2007