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Modeling China's — *and now Iowa's* — mighty QJ 2-10-2's

After being replaced by diesels in their home country of China, a few of these modern, heavy-duty steamers have found their way to the American Heartland / **Robert D. Turner**

Until the end of 2005 one last place remained on Earth where big steam locomotives in substantial numbers were running in regular freight and passenger service on a year-round basis. That place was northern China, and in particular the autonomous region of Inner Mongolia, to the northwest of Beijing. There, on the JiTong Railway, (often written Ji-tong) a stable of rugged 2-10-2's—coal-fired and fire breathing—were still racking up ton-miles every day in an uncompromising display of first-class railroading. These impressive machines were China's QJ class locomotives.

QJ is short for Qian Jin, or "Advancing." It comes from the Chinese revolutionary slogan, "revolution is the locomotive pushing human history forward." Revolutionary rhetoric aside, which I am sure loses something in the translation, it is fair to say that in years to come the QJ will be remembered as one of the most interesting and important types of steam locomotives developed in the 20th century. In fact, two now reside in North America, having been imported by Railroad Development Corporation in June of 2006. They were moved to the Iowa Interstate Railroad soon after their arrival and were operated on its rails over the weekend of September 14-17, 2006.

I met my first QJ early in 2001 on China Rail just before they were retired, and then began to explore the JiTong Railway, where QJ's were in abundance. Subsequently, I saw them many times there and in other parts of China where they were still in industrial service.

The JiTong Railway stretches across Inner Mongolia from Jining, in the southwest, to Tongliao, approximately 590 miles distant, in the northeast. The railway's name is a contraction of the names of the terminals. It is an impressive, well-engineered railroad using massive concrete viaducts along with concrete ties and crushed rock ballast.

What set the JiTong Railway apart for a railroad completed in the mid-1990's was its use of steam power and the installation of classic semaphore signals over parts of the route. Major steam locomotive depots were at Daban and Baiqi, and there were smaller depots at Chabuga, Haoluku and Zhelimu that serviced the railway's steam power. Seemingly out of their time, large numbers of steam locomotives were routinely serviced and maintained in these places until the recent past. Heavy repairs were normally done elsewhere.

The combination of modern working steam locomotives, along with attractive, rugged scenery, made this a very appealing railroad from many perspectives. The railway runs through a region that is intensely cold in winter, where temperatures frequently drop to -30 degrees Celsius or less (below -20 degrees F). A challenging railroad to operate, it was also an exciting one to visit and photograph. Some photographers reported film snapping in the cold, and it was vital to be well dressed to avoid frostbite or hypothermia in winter. Of

course it is not always that cold. Summers can be hot because this is a high, semi-arid region of grasslands and windswept hills. Sandstorms that can blot out the sun and swirl through the valleys with choking dust and grit blow in from the Mongolian deserts, and these can drive even the most persistent and resolute photographer to find cover and huddle around a pot of jasmine tea or a glass of the very good Chinese beer, or "pijue," in one of the small restaurants that serve the local population. These comments aside, there were many beautiful days with bright sunshine and clear skies that made the area a delight to visit. For diesel photography it would still be a wonderful place to explore.

Modern mainline steam

When my friend Jim Scott, of Calgary's Trains & Such, one of my traveling companions on a trip to China a few years ago, told me Bachmann had released an HO scale model of a QJ, my sales resistance crumbled and I ordered one. Although the majority of the production run was intended for the growing market in China, where an increasing middle and upper class now have the disposable income to support this type of product, some were also available in the U.S., Canada and Europe.

In keeping with Bachmann's recent models, this one is a beautifully made miniature and really captures the, impressive lines of the design. Bachmann has released several versions of the QJ, each based on an individual locomotive with differences in headlights and other details, including lettering.

I was, I confess, a little surprised at the size of the model. When I saw the QJ's steaming through the mountains of Inner Mongolia they looked big, and I anticipated a larger model. However, Bachmann's QJ is very accurate, and when I did some comparisons with North American engines I realized that the QJ, although certainly not the largest of the type, is equivalent in overall dimensions to many 2-10-2's (for example, the Chicago & Illinois Midland's 5700's) and the large 2-8-2's used on some roads. They are 95½ feet long.

In operational terms, a QJ can deliver about 3,000 horsepower at the drivers, so one is roughly equivalent to its North American diesel contemporary, the SD40-2 (but of course with different capabilities). It is hard to believe that 2-10-2's were being built in large numbers at the same time the SD40-2 dominated the railroad scene on this continent, but it is true. The QJ's were not normally pushed to their maximum power because, although they were built with mechanical stokers, they were usually hand-fired, which produced a savings in coal. Hand-fired, a QJ would probably not exceed 2,000 horsepower. Moreover, not using the engines to their maximum capacity reduced maintenance.

The QJ was designed and built to be the dominant mainline locomotive for Chinese railroading from the 1960's through the 1980's and into the 1990's. It was a proven design that was very successful. In recent years China also produced two classes of 2-8-2's in significant quantities: the JS, a mid-sized machine for mainline and branchline services, built until 1988, and the SY, made primarily for industrial use, switching and similar duties, although they were also found on local passenger trains. Bachmann has also released very nice models of the SY, including Chinese versions and one decorated for the NYS&W Historical Society' SY, No. 142, the prototype of which operates in New Jersey.

The origins of the QJ are complex. The design draws on Russian experience from the 1930's through the 1950's, and that was influenced by American locomotive practice, as demonstrated in five Alco 2-10-4's and five Baldwin 2-10- 2's exported to Russia in 1931. Russia built large numbers of the FD-class 2-10-2 in the 1930's and 1940's, and also developed a highly successful 2-10-0, the L-class. This, in turn, evolved into the LV-class 2-

10-2, the last type of steam locomotive put into production in the USSR and the basis for the late Chinese 2-10-2's.

Chinese construction of the HP-class (the He Ping or "Peace"-class), the predecessor to the QJ 2-10-2, began in the mid-1950's. The first of these engines were not highly successful, and Chinese steam engineers continued to refine the design, including revising the welded boilers to increase the efficiency of these large, general-service locomotives. Production of large numbers of 2-10-2's began in the mid-1960's. During the Cultural Revolution the engines were called the Fandi (Anti-Imperialism) class, but the designation was changed to QJ in 1971. Production continued for nearly two decades, ending in 1988.

The big QJ's had many features that give them a look familiar to North Americans: Boxpok drivers, Delta-style trailing trucks, smoke deflectors (elephant ears), large six-axle tenders on many locomotives, cast pilots, Worthington-type feedwater heaters, all-weather cabs, knuckle couplers, Walschaerts valve gear, air brakes copied from the Westinghouse ET-6 system, and, usually, big twin headlights on the smokebox fronts. The skyline casing housed an external steam pipe from the steam dome to the overheater or superheater. The combination was an impressive and quite handsome locomotive that clearly shows a lineage that goes back to the North American and Soviet designs of the 1930's.

But, for all their familiarity, the QJ's should be appreciated in their own right, being truly impressive steam locomotives that have earned a special place in railroading history. By the time mass production stopped at the locomotive works at Datong, where most were built, over 4,700 QJ and predecessor types (not counting Russian imports of the FD-class) had been built. By way of comparison, 4,082 GP9's were built for US and Canadian railroads. At one time Datong was producing one locomotive a day.

Improvements were made to the design to increase efficiency and many of the older locomotives were modified accordingly. In the mid-1980's Datong Locomotive Works even developed a gas-powered QJ (QJ(2) No. 0001), but it was not successful. At the same time, David Wardale, the experienced British engineer, worked at Datong to develop what might have become a super QJ. To this end, a standard QJ, 7036, was retrofitted with an experimental cyclonic gas-producing combustion system designed to increase fuel efficiency. Then the 8001, completed in July 1987, was specially built with a re-designed combustion system. (These engines are described in David Wardale's fascinating book, *The Red Devil and Other Tales from the Age of Steam*).

Many improvements to the QJ boiler, combustion system, running gear and appliances were designed, including some pioneered by the well-known engineer L.D. Porta, but the modifications Wardale advocated were not put into production and the construction of new prototypes was shelved. By this time, the shift to dieselization and electrification of China's railroads was clearly government policy: there was no turning back to steam, even with improved locomotives. Standard QJ production continued at Datong until December 1988, when No. 7207 was delivered, ending the large-scale construction of steam locomotives in China. Limited building of 2-8-2's continued until what is believed to be the last SY's were built in 1999. Prototype QJ 0001 is on display at China's huge railway museum just outside of Beijing.

QJ's once roamed all over China Rail's extensive system and were the backbone of mainline services from the 1970's into the 1990's, when the use of steam declined rapidly. By 2000, little steam remained on China Rail. However some of the newer locomotives were still very useful in industrial service or on regional rail lines and were available for bargain prices. This circumstance led to the purchase of used QJ's in the mid- to late 1990's for the newly-

built JiTong Railway. They proved efficient and effective, particularly considering the very low capital costs of the used engines. With the large number once operated by China Rail, there was, at least initially, no shortage of spare parts to keep the remaining steam locomotives running. Until quite recently as many as 120 were on the roster, but by the spring of 2005, as more and more diesels arrived, there were less than 50 and the number declined rapidly. Time ran out for this last major bastion of mainline steam, and the last regular steam runs were in December of 2005, just before the tenth anniversary of the opening of the railway.

The famous Jingpeng Pass, where double-headed QJ's were the norm, was dieselized in March 2005; the last section to use steam, between Chabuga and Daban, followed by the end of the year. Overall, China plans to finish using all steam locomotives by 2008 when Beijing hosts the Summer Olympic Games.

Notably, the support facilities on the JiTong Railway were intended for easy conversion to diesels.

QJ STATISTICS

Cylinders	25.6" x 31.5" (650 x 800 mm)
Driver diameter	59" (1500 mm)
Pilot wheel diameter	36" (920 mm)
Trailing wheel diameter	44" (1120 mm)
Coal capacity	21.5 tons
Water capacity	50 tons
Maximum speed	50 mph (80 km/h)
Horsepower	2,980
Overall weight of engine	133 tons
Minimum operating radius (blind center driver)	475' (145 m)

Note: The QJ's are built to metric dimensions, so the conversions here are approximate.

QJ's often operated in pairs when hauling freight in the mountainous areas between Daban and Haoluku through Jingpeng Pass. Elsewhere in China three could be found on many trains. On the JiTong Railway, freights, except through Jingpeng Pass, usually had one QJ; passenger trains had a single QJ for power over the entire line. The QJ was not the ideal engine for fast passenger trains. They had more power and could handle longer trains than the 4-6-2's they often replaced, but they could not attain the 100 kilometers an hour (60 m.p.h.) speeds of diesels and this contributed to their retirement as China's rail services were improved. Moreover, QJ's operating at the higher end of their speed range were very rough riding, as I found out on a bouncing, galloping cab ride. Impressive locomotives, they will be remembered for the drama they brought to the closing years of world steam power.

Probably the last place where QJ's saw mainline running was on the Dagu Railway, a coal mining line running between Daba and Guyaozi in Ningzia Province in central China. This semi-desert region, including areas of impressive sand dunes and a major bridge over the Yellow River, was a beautiful setting to see the big engines at work. Steam continued there until late in 2006, as diesels took over before the line was transferred to China Rail. By the time this article is in print, steam on the Dagu Railway will probably be gone. A few other QJ's remain on standby or in limited industrial service in mining districts, including Pucheng, Shisi, Zou Xian and Pingdingshan, but their operation is unlikely to last through 2007.

Although a few QJ's have been preserved in China, including several retained by the JiTong Railway, it is unlikely any will be operated beyond limited special services or charters in the immediate future. Having said that, of course I hope I'm wrong.

Dennis Daugherty, Railroad Development Corp.; China, March 2006

When the end was clearly in sight and the majority of the last QJ's was clearly destined for scrap, an American, Henry Posner III, of Railroad Development Corporation, purchased two QJ's, Nos. 7081 and 6988, and took an option on three others. QJ 7081 had the distinction of being the last in mainline passenger service. Both were overhauled to meet U.S. federal operational and safety specifications, and were delivered to the Iowa Interstate Railroad, where they have been put under steam for occasional use. For more about this story see Bob Gallegos' article in the December 2006, *Railfan and Railroad*.

QJ modeling: Phase 1

When my QJ arrived from Trains & Such, I was struck by the excellent detailing and the fine quality of the model. Initially, I didn't pay much attention to the number on my QJ because I assumed that, with over 4,700 of the engines, it would be just a representative locomotive and the chances of ever seeing the prototype for my particular number were slim indeed. However, it turned out that mine was numbered 7141, which is a late production QJ, and one that was sold to the JiTong Railway. Based at Baiqi, the engine usually worked on the section to Benhong at the western end of the railroad, and late in 2001 it was assigned to the passenger service to Benhong. I realized that I might well have photographed the engine near a little village outside of Benhong in February 2002, although I couldn't be sure of the engine number on the passenger train when it passed through. We may have ridden behind this engine when heading east. That was a pleasing thought, particularly because this was the last mainline passenger service complete with sleeping cars and a diner anywhere, as far as I know that was routinely powered by steam locomotives.

Reports from early 2003 showed the engine in freight service, and I had a brief glimpse of the 7141 during a heavy rainstorm at Baiqi engine depot during another trip to China in the fall of 2004 as it was being quickly serviced before being turned around and sent off on another freight.

The model comes nicely painted in gloss black with red drivers, and red and white trim. The real QJ's were painted in gloss and sometimes looked this way, but, as with any steam locomotives burning soft coal, they showed the effects of hard work quickly. I thought my model would benefit from some subtle weathering.

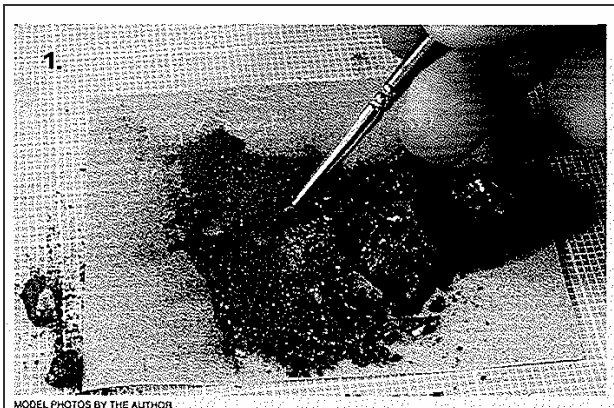
The surviving QJ's, like any large group of engines, went through maintenance cycles, and at any one time some were in better condition than others. A few were also decorated with brass boiler bands, plaques and lettering that gave them a very colorful look. Mine, being a basic service engine, needed some signs of the heavy use these engines received. I wanted to make it as accurate as possible, so I determined to do this project in the most authentic way I could.

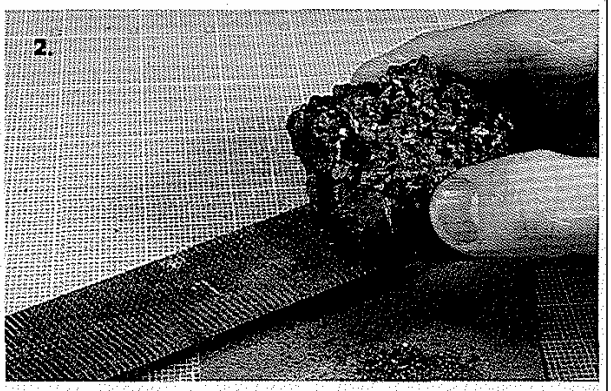
The project was broken down into two phases. Phase 1 was research and materials acquisition.

I very quickly realized that to do things right I had to go back to China. Only there could I obtain the essential research material and supplies. A long air flight (and other adventures) later, I brought back a small lump of QJ coal, destined to be crushed and added to the tender. However, to my surprise when I belatedly looked more closely in the bottom of the Bachmann box, I found they had actually included some coal.

Not to be outdone, mine was still original, verified QJ coal, not just plain, ordinary coal, so I persevered. I also picked up some soot blasted from the stacks of hard-working QJs, from the right-of-way in Jingpeng Pass near a tunnel, and a piece of cinder. Plastic zip-closure bags are ideal for collecting and transporting this type of material, though it can be hard to explain to a customs agent when you come home.

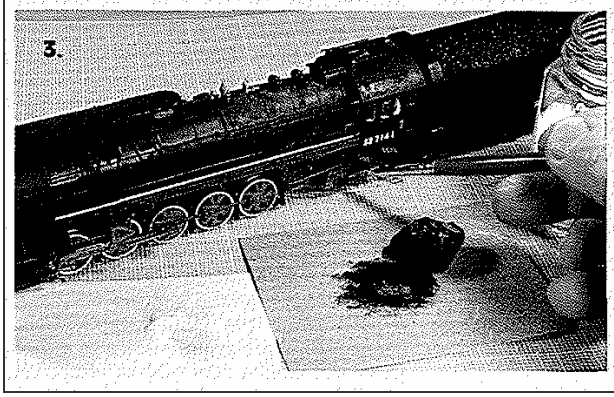
Ground up and applied to the model carefully, this was the real stuff to add an authentic color and texture to the QJ model. I had to use it! [RMC's Bill Schaumburg and I have philosophized that some subtle molecular exchange occurs when such things are done, and this adds authenticity and validation to other materials as well.] After careful prototype research on where and how the grime and grease accumulated on a QJ, I was ready to carry out the weathering.

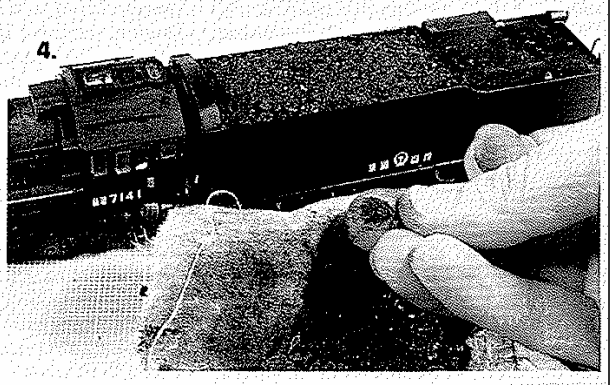




MODEL PHOTOS BY THE AUTHOR

1: Ground up coal is used in the tender and to make a pigment for weathering. 2: The cinder pigment was made using a rasp to scrape off fine pieces. 3: The coal and cinder dust were mixed with acrylic matte medium and the weathering mix was applied around the firebox, cab and boiler. 4: Crushed coal was sprinkled crushed into the tender bunker on top of the plastic coal insert.





QJ modeling: Phase 2

Phase 2 was the actual model building and weathering. The model requires only minor assembly by adding the brake rigging to the underframe of the locomotive and inserting the

plastic coal load to the tender. Unfortunately, this covers up the details of the stoker and tender interior that are all finely modeled. Although some QJ's were really dirty, most of the ones I have seen were fairly clean and well maintained, and it was this effect I was striving for with my model.

I carefully crushed a piece of my QJ coal by placing it in a rag on a rock and thumping it with a hammer several times. (This is precision work, therapeutic model building at its best!) I then ground down the resulting smaller lumps to granules about the size of sugar or less.

The QJ's were fired with a fine powdery coal with some lumps. The crews didn't like the large lumps because they made hand-firing difficult; they often had to be broken up before they could be shoveled through the firebox doors. However, the fine coal, which had to be wetted down, was difficult to fire because the draft could take it out the stack before it had a chance to burn properly.

Fortunately, we don't have to battle this equation in modeling. I applied my powered coal to the plastic insert in the tender, securing it with a diluted solution of acrylic matte medium. (I made a small bottleful using a dilution of about one part medium to five parts water plus a drop or two of dish soap to act as a wetting agent.) I worked the coal around the edges of the pile and then applied a fine coating all over the plastic insert. The results were much more realistic than the plastic insert alone. I also put fine coal and cinders in the skyline casing around the stack where they would accumulate when the engine was around the shops and being steamed up or when running through tunnels.

For a fine powder, I rubbed a piece of coal on a small sheet of sandpaper, quickly getting a wonderful soft gray coal pigment that makes a great weathering material. I brushed this on dry in some areas, and in others I applied it with the diluted acrylic matte medium mix, brushing it on carefully. Since the coal pigment is coarse by model paint standards (it has a texture to it), you can use it to build up a little coal and grime in areas where it would accumulate, but don't overdo it. For most of the work I actually mixed the coal powder into the diluted matte medium mix. Sometimes, applying the coal dust over wet matte medium already applied to a surface worked better.

Generally, I worked from the top of the boiler down to the widest parts, then I went over the front end of the locomotive using horizontal brush strokes on the smoke deflectors and long brush strokes beginning at the stack and going back over the skyline casing. Next, I worked around the running gear and piping. You can vary the intensity of the effect by the amount of coal powder mixed into the diluted matte medium.

I also applied it liberally to the top of the tender tank and then added some concentrations of coal just behind the bunker where coal would fall when the tender was being filled. I was very pleased how this all looked and carried on with the weathering. Have a clean rag nearby because the coal can be quite messy. If you find it necessary, you can give the engine a light spray of a dull lacquer to protect the weathering.

Next came the cinder application. These, too, were ground down to a fine powder. I used an old rasp to scrape off small fragments and also used sandpaper to produce a finer powder. Once again, I used the powder as a pigment in a diluted acrylic matt medium solution and applied it to the running boards, cylinders and pilot where grime and soot would accumulate.

Some weathering comes from dust, mud, sand and grime thrown up onto the running gear and lower parts of the locomotive, but maintenance workers remove a lot of this. Also, in dry areas, there are deposits and scale from the minerals in the boiler water that collect around the steam turret, safety valves, blow-off cocks and in a few other spots around the boiler and trailing truck. I used a little diluted acrylic gray and burnt umber with my coal and cinder pigments to show traces of boiler deposits and rust in appropriate areas and around the tender trucks.

I like this approach to weathering because, first of all, it is very realistic, but equally, it is incremental and you can build up the effects gradually in layers. It is also quite forgiving and you can remove layers with a damp brush or cloth as long as the acrylic medium has not hardened. It is also a low-tech approach to modeling and doesn't take a lot of equipment or set up time. I liken it to making a painting of a weathered locomotive more than anything else and find it quite relaxing. Generally, I prefer weathering to be understated and subtle, rather than heavy and overdone. It is all a matter of taste and also of representing the particular engine you are modeling. Sometimes the effect is not so much changing color as changing texture and shininess. The pop valves, whistle and other boiler fittings supplied in a brass color usually appear black on locomotives.

Next, it was time to deal with the drivers and running gear. One serious cautionary note is to be very careful that you do not get the coal or cinder pigment on any moving parts of the model or where they could get into the bearing or gears. They are abrasive. For weathering the rods and valve gear, used acrylic paints, well diluted and applied with a dry brush.

There were normally three engine crews assigned to each QJ, and the men did a lot of the cleaning and servicing of the engines themselves. Of course, some crews took more pride in their engines than others, but generally, the Chinese crews kept the brightly-painted drivers and running gear clean and polished. This was also safer because any cracks or damage would show up more quickly this way. I've watched engine crews wiping down the boilers, smoke deflectors and the tender sides, making considerable effort at maintaining the appearance of their engines. As a result, a lot of grime is inappropriate unless you want to depict an engine about to be overhauled, one in from really heavy winter or industrial service, or perhaps one that doesn't get much attention from its crews. The bright red drivers were a distinctive feature of these engines, not too hard to duplicate, and added color to them.

Attaining the polished look around the running gear raised a question. What would work? The crews used cotton rags and waste, just as railroaders in North America did during the steam era.

It occurred to me, after a clarifying glass of pijue, a.k.a. Chinese beer, (note that Tsingtao beer is available in North America) and some thoughtful contemplation, to go back to China to get a piece of oil-soaked rag or cotton waste to apply QJ grease to the model. However, reality suggested a more immediate and practical solution, and, besides, the grease would damage the plastic on the model. Instead, I used acrylics to highlight and weather the running gear.

I am very pleased with the results of the weathering and it looks right. Except for the grease and oil, there really is no substitute for using the real stuff when you can. It has the right color and consistency, just what you would find on the real QJ's in Inner Mongolia or at the last China Rail steam depots like Da'an or Harbin in northern China. If you can't go to China for your coal and cinders, you can use local coal, charcoal or even a barbeque briquette.

Not everyone has a QJ waiting to be weathered, but this technique is more widely applicable. For example, I've used coal from Colorado and New Mexico for detailing and weathering some of my Rio Grande narrow gauge engines.

Sometimes model building is a demanding hobby, but with something like a QJ, you've just got to rise to the challenge. Alas, the end is not in sight, since I recently acquired a Bachmann's SY 2-8-2.

Quite a few SY's are still in use and a few of them were built as recently as 1999. There are some running at Tiefa, in northern Liaoning Province, an overnight train ride northeast of Beijing, and not far from the Inner Mongolian border. Now, let's see, they burn locally-mined coal, so that's easy, and they are very clean engines, and there was that spotless one with brass boiler bands that looked really nice. There was also the one that worked at a cement plant, not far from Beijing, and it was one of the most heavily weathered engines I have ever seen. Indeed, the possibilities for combining, modeling and travel are endless.

Thank you

I am indebted to many people for information, travel planning, organization and other help in making my QJ photography and modeling project possible. They include Don Herron, Jim Hutzler, Ron Amberger, Jim Scott, Bernd Seiler, Lou Young Mei, Zheng Bo, and Amanda Zhang Yuan, and of course many workers on China's railways. In addition my thanks to the contributors to the "Steam in China" chat line and to Hans Schaefer for his excellent website "Chinese Railways," which has much material on the QJ's (http://home.c2i.net/schaefer/chinarail.html), for this information and other QJ details. As well, there are other excellent websites including "QJ Country" by Florian Menius, at www.qj-country.de; Duncan Cotterill's "Railography" www.railography.co.uk; Bernd Seiler's outstanding FarRail Tours site, www.farrail.com; Robin Gibbon's "Railways of China," www.railwaysofchina.com; and Brian Haworth's "Chinese Railways" http://home.iprimus.com.au/unionrr/4.html, which has links to other sites and model suppliers.