The glass house

The inquest into the Ufton Nervet crash led to calls for stronger train windows, which would protect passengers in the even of an accident. One company was already working on a solution – Simon Roberts visits Independent Glass's Glasgow factory

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'RSSB wanted to contain passengers within a window already broken – no toughened glass in it and the laminated smashed. They also wanted a firemen to be able to walk on it' John Devine

Little by little, rail accidents that once would have been catastrophic are becoming less so as safety technology improves. Sometimes inquests and public inquiries can be the catalyst for change. As Rail Professional reported in the December issue, there's been a resounding call triggered by the Upton Nervet crash – in which six died – for windows able to stop passengers from being hurled from a carriage on impact.

In fact, Glasgow-based Independent Glass (IG) was ahead of the game on this. The Gorbals-based manufacturer had been on the case since 2003 when GNER approached it for a product that would offer passenger containment as it sought to upgrade old Mark 4 coaching stock. Aside from crashes and derailment, trains must cope with vandals throwing stones or firing air rifles. As GNER came calling, IG had just commissioned a new rig to conduct exhaustive tests of its new safety glass. It comprised a toughened outer piece and laminated inner one with a gap between, designed to deal with extreme situations.

IG has flourished since it was formed in the Gorbals by John Devine in 1989. Forty-five years in the industry, Devine started as a glass cutter in London on leaving school and served a five-year apprenticeship before moving up through the ranks, latterly setting up IG with a staff of seven.

The company has grown steadily, developing specialisms and expertise. It now employs more than 250 people on two sites in Glasgow and at a newly-acquired factory in Mansfield, Nottingham. This will boost capacity and incorporates a hi-tech laminating plant, toughening plant and a further heat soak facility. It also offfers a more central distribution hub from which to serve the UK and Europe.

The story of IG's work with the rail industry is one of dedication to safety. Its philosophy is 'no short cuts; no margin for error'. This stance has entailed building the new testing rig and hiring the best brains – in this case an ex-Pilkington research and development specialist. And the project has proved to be quite an education for staff.

'You can test a piece of glass that will perform one way but another piece cut from the same sheet will perform differently,' says IG marketing manager Chris Hogg. 'We also learned you can't test a small sample – it must be more or less the size of the unit. Most people were testing glass where you just rest it horizontally on a box and drop the missile from a great height. We thought it should be tested vertically. With the speed and weight of the ball we were using, the impact velocities are virtually ballistic.

'We said to GNER, we'll quote you with styles in mind but if, with the small missile test, this stuff doesn't perform, we'll take out all the glass units free of charge and give you new ones. But because of the space between the two pieces, it worked well. The cavity was big enough so that by the time the ball hit the laminated inside, it

virtually absorbed the energy. We spent from 2004-05 doing test after test.'

This was when First Great Western came knocking. 'Upton Nervet had just happened,' says Hogg. 'They said, "we want to look at changing all our fleet – we hear you have units that will fit into the existing windows, so what can you do for us?"'

It so happened the Rail Safety and Standards Board (RSSB) was already working on a research project to strengthen laminated glass, and asked IG to carry out some stringent new tests. 'RSSB wanted to contain passengers within a window already broken – no toughened glass in it and the laminated smashed,' says Devine. 'They also wanted a firemen to be able to walk on it.'

Another tall order. IG's solution had not only to be safe but slim enough to be accommodated by existing window frames. 'Changing the frame would have meant altering the body side shaping and interior fittings,' explains Devine. 'It would have been very expensive and would have taken years to redesign. You have to work with everyone – we also had the Department of Transport saying "you've got to keep these trains light". We've been able to do everything required but stay within acceptable weight limits and use the existing frames. That's a big cost saving – the frame is considerably dearer than the glass.'

IG came up with a design whereby the laminated was heat-treated and its stresses altered. 'By doing that, they break in different fragmentation patterns and that adds strength,' says Devine. 'The toughened outer skin is also stressed beyond the industry standard norm. We'd already built so much margin into the unit it went through the test with no problems. What we're using is the best of both worlds: laminated and toughened glass. It's a combination unit, performing all the requirements of existing tests and new ones. Toughened enables it to take an initial impact without completely shattering – it acts as the first skin. Laminated will take a bigger impact before it cracks.'

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The test for toughened glass – to ensure it complies with safety standard BR 573 – must show that it won't fall out when it breaks. For this it's placed in a chamber and subjected to forces the equivalent of two high speed trains passing in a tunnel, creating pressure and suction. 'We do that 20 times and when it's over the panel still has to be in place,' says Devine. 'It's a wicked test for a piece of toughened glass. But if you had pieces starting to break away it would be like a sand blast.'

Rail industry critics – especially those who've seen loved ones killed or injured in crashes – may wonder why the drive for installing safer glass did not come earlier. But Hogg believes train operating companies (Tocs) have been unfairly criticised.

'There used to be people in British Rail engineering who were glass men but when privatisation came in, those people were getting to retirement age,' he said. 'And unfortunately in the glass industry a lot of the training schemes have gone, so you have a dearth of people with knowledge. I hear people say if this glass had been put in beforehand, Upton Nervet wouldn't have happened but the unit wasn't available until after then. We were still working on it. Other laminated units out there were far too thick to go into existing frames so there wasn't anything for the railway companies.'

Moreover, says Devine, the process IG uses – the ability to laminate pre-stressed glass to the same extent as new glass – wasn't generally available until a few years ago. 'The first thing FGW did after Upton Nervet, as soon as they knew we working on it, was come to us and say "can you incorporate this? If so we'll go with you,"' says Hogg. 'Now all the other train companies are saying "what can you do?" and

John Devine (left) and Chris Hogg with a test sample.

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taking the matter seriously.'

IG is now doing business with FirstGroup and GNER, and work is coming in from Arriva trains. 'GNER and First have been actively involved in creating the answer,' says Devine. 'Once they were satisfied the answer was there, they were prepared to put their money where their mouth was. It was refreshing – the attitude was "let's get this thing solved". There's a lot more involvement now, people saying what can you do? How can you do it?'

The IG unit can replace existing 18mm thick toughened and toughened double glazing units in pre-1994 stock. The Rail Safety and Standards Board says it will 'substantially improve the survival rate... where there is a train accident.'

To be in pole position is a badge of honour for a smallish factory in Glasgow. 'People across Europe have been working on glass safety for years. We saw inherent problems with some of the solutions and just quietly got on with things,' says Devine. 'We wanted to make sure that if anyone ever came to us, we could say: "We can do this" – and we know it will work'.

IG estimates total development costs at 'probably near half a million' – a big commitment but one that has been drip-fed over the years. Rather than an explosion of new business it has, to date, resulted in a few substantial contracts with the possibility of more to follow. 'We're not looking to recoup the initial investment in the first three contracts; we are looking at going forward with a long-term answer,' says Devine. 'I consider it money well spent.'

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IG says it's striven to keep prices as low as possible. Projects include Mark 3s for FGW and GNER and it's started on 158s for First Group. 'Arriva are looking at their Mark 3s; and there's a tender out for 442s,' says Hogg.

It's been the catalyst for a shift in direction. 'We're putting a larger emphasis on this than for some traditional markets we used to be involved in,' says Devine. 'We've moved up a few degrees. The next area we want to look at is road transport; though there is more to be done in rail. It's a relatively small sector. We put the money into a market place that was OK for us. The big thing now is about energy saving and fuel efficiency.

'For us, this is just the start of a journey. But the benefit is that because we can meet people's requirements with the products we have to hand, it means we can start developing using the same principles but with slightly different products.'

IG is also looking at export potential. 'France is the easiest market in terms of logistics but we have started to talking to Siemens in Germany,' says Hogg. 'We've taken on someone to look after Germany, France and Austria, with the aim of pushing this and other products. We expect this will provide a solid platform from which the company can venture into Italy and further into eastern Europe.

'What makes us stand out is that we didn't rely on calculation but more on physical testing of representative-sized samples in "as glazed" aspect. Things were shown to work by calculation but didn't work when you started physically testing them. There's too much to lose if you get it wrong because this is a safety-critical part. Getting it right has always been IG's imperative,' says Devine. 'That's the only way to be – we know that, with the components we use, they'll work every time.'