

# Tie Pads Reduce Life Cycle Costs





## Study confirms: Elastic bedding reduces track superstructure deterioration

**According to a study conducted by the Graz University of Technology, the use of tie pads has resulted in improved track quality throughout the Austrian Railways network. The findings show that tie pads reduce deterioration of the ballast, the most critical element in the track superstructure. The improved track quality behaviour extends the maintenance intervals and substantially increase the overall service life of the superstructure.**

**T**he increasing rail traffic volumes and higher vehicle speeds are subjecting tracks and turnouts to steadily increasing loads. This is in turn causing accelerated deterioration of the individual track components and higher track maintenance costs. The fact that tie pads reduce deterioration on ballast superstructures has already been shown in calculations as well as long-term tests on a variety of test sections. Now, further proof has been provided by a study conducted on the Austrian national rail network by the Graz University of Technology.

Austrian Railways (ÖBB) conducted their first tests with tie pads in 1997 to assess their deterioration-reducing effects on ballast bedding. The results showed a 50 % reduction in track deterioration rates, facilitating at least a 100 % extension of the tamping cycles. Because of these positive results, Austrian Railways is installing tie pads on more and more tracks. Under certain conditions<sup>1</sup>, concrete ties with tie pads

are now the standard solution for mainline tracks and turnouts<sup>2</sup>.

<sup>1</sup> > 33000 total short-tons/day; speeds > 100 mph; tracks with radiuses < 1970 ft. Only one of these three conditions must be met.

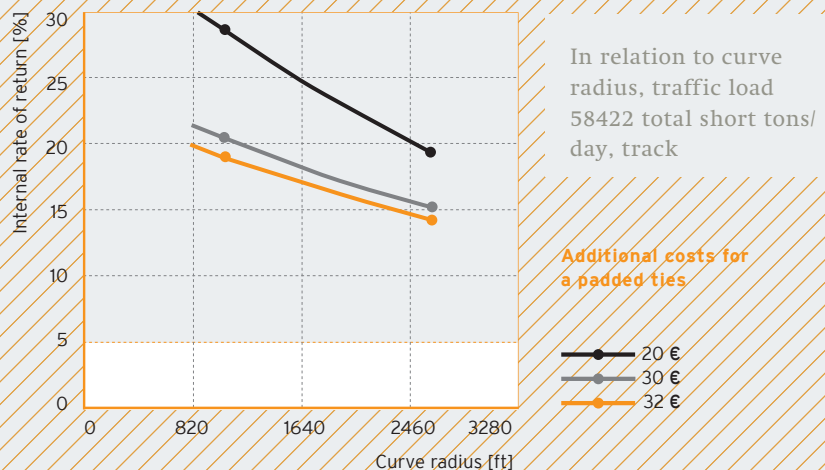
<sup>2</sup> See also ZEVrail 133 (2009) 5 May, pp 180 ff.

### The study: Economic Benefits of Tie Pads (WINS)

The aim of the WINS project was to verify the findings collected in the various test sections by examining the entire rail network. "Our measurements on over 1,500 cross sections showed significantly improved track geometry in the sections equipped with Sylomer® SLB 3007G

tie pads. This means that the maintenance intervals can be extended on track sections with tie pads, and that the overall service life of the track superstructure in these sections will be considerably longer. This also reduces the costs associated with operational hindrances. These effects significantly lower the life cycle costs of the superstructure, even taking the higher investment costs into account", explained Professor Peter Veit, institute director and faculty chair at the Institute for Railway Engineering and Transport Economy at Graz University of Technology. Using the results of the study, the experts developed a life cycle costs calculation instrument that can be used to calculate the cost efficiency of a

### Economic benefit of Tie Pads - internal rate of return







solution with tie pads. This LCC model offers a statistically sound decision-making aid for track strategy that takes the specific cost structure into account.

#### **Tie Pads offer the greatest savings on heavily loaded tracks**

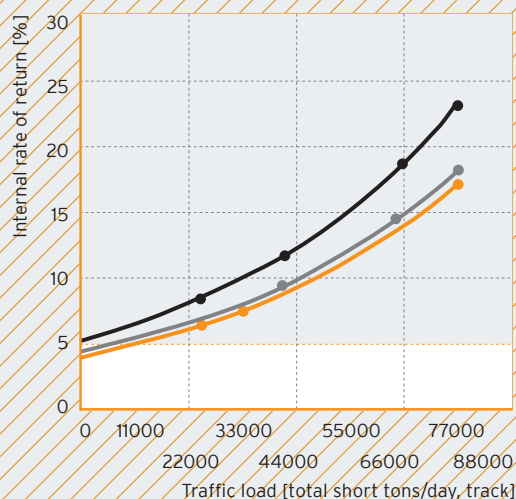
Tie pads offer the greatest cost savings when they are installed on track sections subjected to especially high loads. There we can find the biggest economic advantage. "At a daily traffic load of 77000 total short tons, we see a static cost reduction of one third or an internal rate of return of 16 %", said Stefan Marschnig from LCC rail consult, a research partner of Graz University of

Technology, summarising the results. An internal rate of return<sup>3</sup> of 5 % is already achieved at a traffic load of 11000 total short tons per day. The saving effects of under tie pads will be increased further when considering tracks with tighter curve radii. Individual analyses have shown that softer tie pad types like Sylomer® SLS 1308G result in further improvements of track quality. "In general, it can be said that tie pads are a technically and economically proven solution for reducing the total costs of a track superstructure," said Professor Peter Veit, summarising the results of the life cycle cost study.

<sup>3</sup> This internal rate of return is based on the additional cost for the pads. In other words, this value indicates at what interest rate the tie pads refinance themselves, or how fast the positive effects from the pads, such as reduced maintenance expenses and increased service life, pay for the additional investment. The lower limit of 3.5 % is identical to the bank rate. Austrian Railways requires a rate of 5 % for the implementation of innovations. All of these interest rates are real rates, in other words not accounting for inflation.

» Some 980,000 ties and 350 turnouts with Getzner pads installed worldwide. «

#### **Economic benefit of Tie Pads - Internal rate of return**

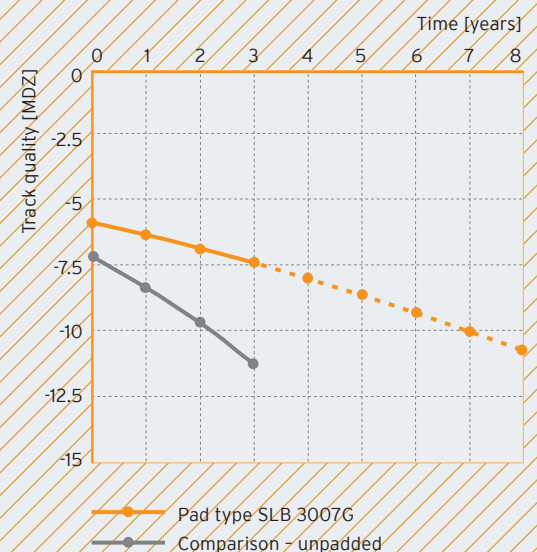


In relation to traffic load,  $R > 1970$  ft

Additional costs for a padded ties

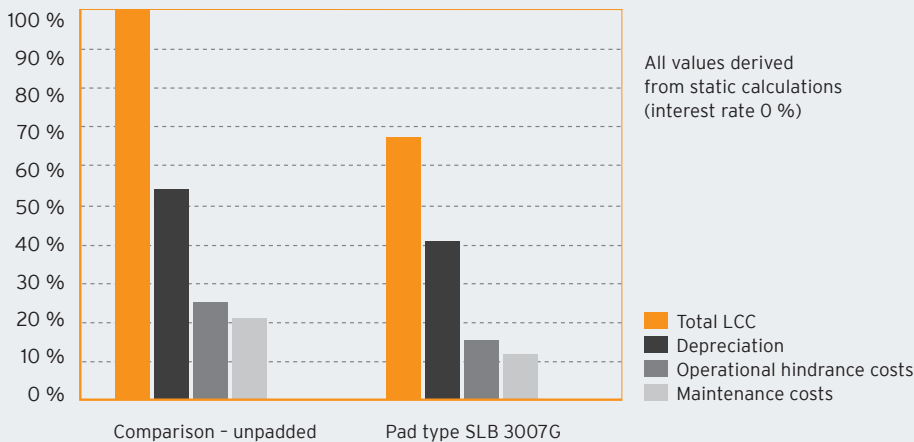
—●— 20 €  
—●— 30 €  
—●— 32 €

#### **Track quality**



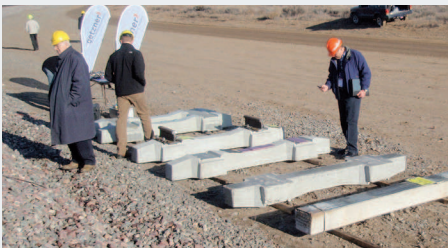
## Breakdown of standardised annual costs

Traffic load > 77000 total short-tons/day, straight track



### Long-term tests on sections with extremely high axle loads

The results of the LCC model confirm that the return on an investment in tie pads increases in line with the traffic load. This implies that installing tie pads would be an effective way to reduce costs especially on sections with extremely high axle loads. Getzner Werkstoffe is currently examining this effect in more detail on lines with 40 short-tons axle loads, and similar results are expected from the long-term tests at the Facility for Accelerated Testing Service in Pueblo, Colorado.



### Cost reductions through LCC analysis

- Tamping intervals extended by at least 100 %
- 50 % less track possessions on the line
- Total service life increased by at least 25 %
- Less rail corrugation in tight curves
- Better track quality, and thus improved comfort
- Advantages of timber ties combined with the benefits of prestressed concrete ties
- Greater contact area between the concrete tie and ballast bed (and up to 90 % less unit pressure on the ballast)
- Less ballast settling

### The WINS study in brief

- The world's first statistical proof of the investment return offered by tie pads on the basis of a full rail network analysis in cooperation with Austrian Railways
- At least a 10 % rate of return on the additional investment
- The higher the track load, the more the investment in tie pads pays off