

## CASE STUDY

# PARDAK® 90

## WESTFIELD STRATFORD CITY, LONDON





# SPEEDING UP CONSTRUCTION

**A fresh approach to rooftop parking has been taken at the recently opened Westfield Stratford City - the largest urban shopping centre in Europe and the gateway to London's Olympic Park. Here, Zoontjens modular tensioned-slab paving system was used over an inverted, in-sulated roof to provide a durable and safe car parking surface for visitors to the centre. This project follows over 30 years experience with tensioned-slab technology.**


Originally developed in 1987 in the Netherlands, the precast concrete slab based Pardak® decking system for roofs accommodating intensive passenger car traffic and parking, with applied loads of up to 35 kN. Around 1.5 million square metres of this system have now been installed around Europe.

The system uses dry, prefabricated construction techniques for fast, safe installation, unaffected by most weather conditions. A reinforced version is also available to accommodate emergency vehicle access.

The system consists of high quality, vacuumformed concrete slabs supported

on pressure distributor pads with adjustable tensioning elements. The pressure distributor pads sit directly on high strength XPS polystyrene insulation at the Westfield project - so eliminating any cold bridging - and the flexibility of the system compensates for uneven surfaces.

Each slab is profiled on the sides with drainage slots and supplied as standard with a raised diamond pattern. The compressive strength is at least 65N/mm<sup>2</sup> which significantly increases over the years. The underside of each slab is cast with rebates of different depths that receive the pressure distributors and adjustable tensioning elements.







## SPEEDING UP CONSTRUCTION

At Westfield Stratford City, around 15,000m<sup>2</sup> of this system have been installed over an inverted, well-insulated roof in open, upper areas directly over retail space in the new centre. Using Pardak<sup>®</sup> enabled the reinforced concrete slab with metal decking soffit to be waterproofed far earlier than a conventional insulated slab, allowing work both above and below to proceed sooner, including fit-out of retail areas on lower floor levels. It also avoided delays resulting from concrete screeds to cure or other wet processes and no special details were needed to span expansion joints.

Rigid, high strength XPS polystyrene insulation slabs were laid over the deck followed by installation of the paving system, all by Zoontjens - working for the waterproofing specialist BriggsAmasco. The complete system, including insulation, involved only dry, prefabricated construction "Using Pardak<sup>®</sup> enabled work both above and below to proceed sooner" techniques, largely unaffected by weather and also enabling product storage and handling on areas of just-installed paving, giving far better programme reliability.

Zoontjens rose to the logistical challenges of working on the largest construction site in Europe. Some 200 loads of product were transported from the southern Netherlands and delivered on time to fit in with the main contractor's tight time-slot allocations. Zoontjens managed its own craneage on site and installed 2,100m<sup>3</sup> of insulation below the paving as well. At the peak of site activity, five or more loads were being delivered every day to meet the highest laying rates exceeding 500m<sup>2</sup>. The concrete slabs at Westfield Stratford were installed by Rooftop-paving using a vacuum-lift machine. With extensive machine-lay experience and long-standing relationship with Zoontjens, Rooftop-paving achieved some 1,500m<sup>2</sup> per week despite the constrained building environment.

**"THE SURFACE REMAINS FREE OF WATER, AND ICE IN COLD WEATHER, MAKING IT SAFE FOR BOTH VEHICLES AND PEDESTRIANS"**

## INTEGRATED SUSTAINABLE DRAINAGE

The regular pattern of surface grooves in the slabs and the pre-formed slots between installed slabs allow water to move rapidly off the surface without the need for falls, into the void below. Here, water runoff can be attenuated before discharge, as part of a SUDS strategy to meet the requirements of the new Flood and Water Management Act. The surface remains free of water – and ice in cold weather – making it safe for both vehicles and pedestrians. The void below can also accommodate service cables with straightforward access when needed. The paving system protects the waterproofing membrane from UV, structural and other damage, while keeping it accessible, as individual slabs can be removed easily. In fact, the system can be rapidly dismantled if necessary.

The 400mm diameter, 30mm thick pressure distributors absorb and distribute the vertical and horizontal forces that occur when a vehicle passes over the parking surface. They also reduce contact noise of the vehicle tyres and allow rapid water drainage to outlets, via the cavity below the concrete slabs. Pressure distributors fit into the quadrant- “The surface remains free of water, and ice in cold weather, making it safe for both vehicles and pedestrians” shaped corner rebates on the underside of the slabs. The function of the tensioning element is to close the slabs up against one another to create an integral, interacting whole where horizontal forces exerted by vehicles braking, decelerating and turning are distributed among several slabs.

The internal components of the tensioning element are drawn together to create an outward force and a maximum 4mm increase in diameter. The bolt, tensioning plate, nut and body are fitted together to form the complete tensioning element. The slabs are then located over the tensioning elements which fit into the deeper corner rebates on the underside of the slabs. When the slabs are in position, a screwdriver fitted with a bolt head adapter is used to adjust the tension within each of the tensioning elements, transferring an outward force of 60N to the slabs. The adjustable tensioning element compensates for differential movement of the slabs, because of its self regulating action. It will also accommodate thermal movement of the building and the slabs, and movement of the slabs due to heavy traffic as well as product and installation tolerances.



## ON-GOING DEVELOPMENT

The recently developed Pardak® 110 system takes these principles further. The main changes are considerably more effective tensioning elements, plastic corners enabling accurate slab height levelling and increased slab sizes to a 110cm x 110cm grid, from the previous 90cm square grid size used at Westfield. The capabilities of the new system were demonstrated with 1,400 parking spaces spread out over some 36,000m<sup>2</sup> on the roof of ‘The Wall’ – at 800m, the longest building in the Netherlands.

This retail and leisure building forms an acoustic barrier between the A2 motorway near Utrecht and adjacent areas. The new system on ‘The Wall’ in Utrecht demonstrated substantially lower sound generation values (for example from shopping trolleys) than previously. This is due to the more intensive horizontal and vertical tensioning of the new system. Zoontjens is also turning their attention to refurbishment of rooftop car parks. Here, the prefabricated and machinelaid tensioned slab paving system can be installed quickly to minimise ‘down-time’ while rejuvenating older damaged roofs.

## WHAT IF THE WORLD WERE TWICE AS BIG?

It can be, as far as we're concerned. Our world, twice as big. A world that we are helping to design and construct perfectly with our roof slab systems. Our many years of experience have made us the number one expert in rooftop paving. For sustainable roofs, livable roofs for socialising.

We interact with architects and contractors every day. With roofers and project developers: Creators and constructors. We listen to them, work with them and advise them. That's why we're the number one party with the best rooftop vision. It's our higher ground.

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