防災・減災への取り組み
Efforts for Preventing and Mitigating Disasters

阪神高速道路の耐震補強
Seismic retrofit projects on the Hanshin Expressway

橋脚の補強
鋼製橋脚の中にはコンクリートを充填、コンクリート橋脚には鋼板を巻き立てて、橋脚の強度とじん性を向上しています。

Strengthening of bridge piers
To improve strength and toughness of existing bridge piers, steel structures are filled with concrete, and concrete structures are jacketed with steel plates.

桁かかり長の確保
地震によって橋桁が落下することのないよう、橋脚のはり部分を拡幅します。

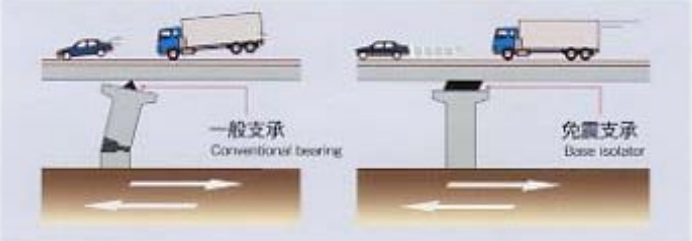
Ensuring adequate seating of girders
The beams of bridge piers have been made wider to keep the girders from falling during an earthquake.

落橋防止装置の改良
想定以上の地震動で、橋脚と橋桁間に予期しない相対変位が生じた場合でも落橋することがないように、橋桁どうし、または橋桁と橋脚をケーブル等で連結します。

Improving bridge restrainers
Connections between adjacent girders or those between the girders and piers have been improved using cables and various devices so that the bridges will not fall down when relative displacement between a pier and a girder is unexpectedly large due to strong seismic motion.

免震支承への取り替え
地盤からの地震の揺れを橋桁に伝えにくくし、地震力を低減させるために、柔らかく、揺れを減衰させる積層ゴムを用いた免震支承を採用します。

Changing to base isolators
Base isolators made of laminated rubber are soft and absorb seismic force, so attenuating the energy and reducing the ground motion transmitted to the bridge girders.



橋桁の連結
橋桁どうしを直接つなぎ合わせることで、地震による橋桁の落下を防ぎます。

Making girders continuous
Girders have been made continuous to prevent them from being unseated.

長大橋に適用した免震・制震技術
Seismic isolation and control technologies applied to long-span bridges

すべり免震システムと座屈拘束ブレース（港大橋）

港大橋では、床組（車両が走行するデッキ部分）を支える金属支承をすべり免震支承に取り替えて地震力を低減し、「主構」とよばれる主要部材（橋の骨格となるトラス部材）に損傷が生じないようにしています。また、二次部材（主要部材を補助する部材）である対傾構や下横構にある程度の損傷を許容し、地震エネルギーを吸収させて主要部材を健全な状態に保つ「損傷制御構造」を採用しています。具体的には、対傾構や下横構を座屈（両端から強い圧縮力を受けてひしゃげるように破壊すること）から防ぎ、地震エネルギーを吸収する「座屈拘束ブレース」に取り替え、主構に損傷が生じないようにする制震技術を用いています。

Sliding seismic isolation system and buckling-restrained braces (Minato Bridge)
The floor system, or bridge decks on which vehicles travel, of the Minato Bridge was previously supported by metal bearings. They have been replaced with sliding base isolators to reduce the seismic force, thereby preventing damage to the main truss which is the framework of the bridge consisting of main or primary members. The other feature of the retrofit on this bridge was the adoption of a damage control system. Sway bracing, bottom lateral bracing and other secondary or supplementary members are designed to withstand damage to a certain degree so that they absorb seismic energy and keep the primary members intact. This seismic control has been achieved in practice by replacing old sway and bottom lateral bracings with buckling-restrained braces which are capable of absorbing seismic energy without buckling (crumpling under strong compression from both ends).

座屈拘束ブレース
Buckling-restrained braces


すべり免震支承
Sliding base isolators


積層ゴムばね
Laminated rubber spring