Synopsis
The Matoba Viaduct is a continuous prestressed concrete box girder bridge located within the Hamamatsu-Inasa Junction on the New Tomei Expressway. The viaduct crosses the Matoba River, which is one of the most important habitats for fireflies. Today, public works are expected to take the environment into consideration, so to ensure conservation of biodiversity, the design of the viaduct took special measures to minimize the impact on the river environment when constructing the main Matoba Viaduct and Ramp D Viaduct 3. To achieve these objectives, the viaducts were constructed by cantilever erection using precast segments so as not to require full staging at the site.

Structural Data
Structure: (Eastbound Lane) 9-span continuous prestressed concrete box girder bridge
(Westbound Lane) 7-span continuous prestressed concrete box girder bridge
(Ramp D-3) 5-span continuous prestressed concrete box girder bridge

Bridge Length: (Eastbound Lane) 403.5m,
(Westbound Lane) 364.0m,
(Ramp D-3) 234.0m

Span: (Eastbound Lane) 27.9m + 7@48.0m + 37.4m
(Westbound Lane) 55.4m + 2@60.0m + 44.5m + 48.0m + 48.5m + 45.4m

Fig.1 Matoba viaducts
bridge forming part of this new section, located within
the Hamamatsu-Inasa Junction.
Special construction requirements for the Matoba
Viaduct were conservation of the environment of the
Matoba River within the construction site, and a short
construction period to enable early handover of the
construction yard of the main viaducts and Ramp D
Viaduct 3 for pavement construction.

2. Outline of Construction
The Matoba Viaduct project consisted of a total of
four viaducts, comprising the main Eastbound Lane
and Westbound Lane viaducts (“main viaducts”),
Ramp C Viaduct 3, and Ramp D Viaduct 3 (“Ramp
D-3”). With the exception of Ramp C Viaduct 3,
which is positioned away from the Matoba River,
each of these viaducts is designed to minimize the
impact of construction on the river environment and
to shorten the construction period by using precast
segments erected by a cantilever erection. The project
incorporated proactive biodiversity conservation by
working together with local residents and creating a
biotope within the construction site where fireflies can
lay their eggs.

The main viaducts used cantilever erection of segments
comprising the core section plus ribs. The deck slab is
then cast in place after erection. This approach gives a
prestressed concrete panel composite slab structure that
is efficient to construct. For Ramp D-3, the complex
linear shapes typical of expressway ramps required
sophisticated management for segment fabrication. As
a result of these measures, the viaduct was successfully
completed without problems. This report focuses on
the design and construction technology that enabled a
short construction period despite incorporating special
measures to conserve the environment.

The general views of the structures are shown in Fig.2.

3. Cantilever Erection Using Precast Segment
For the main viaducts, the segments were transported
on the deck slab of the viaduct and then erected using
erection girder. For Ramp D-3, in order not to disturb
the fireflies’ habitat, the segments were erected from
an existing road using a crawler crane. Consequently,
the assembly of formwork and steel reinforcements,
the placement of concrete, and other work normally
performed at the erection site could largely be
performed at a separate location. As a result, the work
at the erection site was greatly reduced and successfully
minimized the environmental impact of the river
(Fig.3). The erection of the main viaducts and Ramp
D-3 are outlined below, together with a description of
special approaches used in the cantilever erection of
precast segments.

(1) Outline of Main Viaduct Erection
The steps used in erection of the main viaducts are
shown in Fig.4. The pier head is constructed first
as a cast-in-place unit. The segments are then cast
in a casting yard established on the earthworks area
behind abutment A2, transported on the slab deck of
the viaduct on trolleys, and then erected using erection
girder (Fig.5). The weight of the erection girder was
about 420 t. This approach enabled the elimination of
temporary piers and large staging in the vicinity of the
river, minimizing the impact of construction on the
river environment. The cantilever construction was
performed using core segments so that prestressed
concrete panels could be laid directly onto ribs after
errection, and cast-in-place concrete then placed on
the panels, producing a prestressed concrete panel
composite slab structure. This prestressed concrete
panel composite slab structure was adopted for the
purpose of reducing the weight of segments, and also
allowed smaller equipment to be used for segment
casting and transportation. The size of reduction of
errection equipment minimized environmental impact
on the river and also economical, as the cost of the
erection process was similar to the cost of erection
using staging.
As ramp D-3 runs alongside the Matoba River, a precast segment construction method like that for the main viaducts was used in order to minimize impact on the river environment. To avoid impact on the firefly habitat, erection work on the area immediately adjacent to the Matoba River was paused from March to June when the fireflies are active on land. The steps used in erection of Ramp D-3 are shown in Fig.6. The pier head is constructed first as a cast-in-place unit using full staging. The segments are then cast in a casting yard established on the earthworks area behind abutment A2, transported along a public road on a low bed trailer, and then erected using a crawler crane (Fig.7). The segments were erected using cantilever erection for piers P1 - P4, and full staging for the side spans at abutments A1, A2, which are located away from the river. The initial plans called for erection using full stagings, but this method greatly reduced the installation of stagings close to the river. The segments were fabricated by casting using a short line match cast method in a casting yard set up on the earthworks area behind abutment A2. It is a method of fabricating a NEW segment by using OLD segment as a cross section formwork (Fig.8). Three fabricating beds
概要
的場高架橋は新東名高速道路の浜松いなさジャンクション内に位置するPC連続箱桁橋である。近年、建設工事においては、環境に配慮した施工が望まれている。本橋の架橋位置には、ホタルの生息箇所として有名な的場川があり、その生物多様性保全対策として的場川を横断する的場高架橋上下線、Dランプ第三橋を、河川環境への影響を最小限とし、かつ工期を短縮するために、架橋位置で固定支保工による施工を行わないプレキャストセグメントによる張出し架設工法で施工した。また、本工事では、現場内にホタルの産卵場としてビオトープの整備を行うなど、積極的に生物多様性保全活動に取り組んだ。

6. Conservation of Firefly Habitant During Construction
Adopting a precast segment construction method created a space below the viaduct, which was used to construct a firefly biotope (Fig.10). River improvement work has changed the cross-section of the Matoba River, and the sandbanks and similar places that provide a habitat where firefly larvae can hatch are now often inundated when the level of water in the river rises. The biotope was designed to provide an additional riverside area for the fireflies to lay their eggs. It was designed by Prof. Yamada at Fuji Tokoha University, providing a total of 45 m of restored river environment with rocks, trees, and grass. The water flowing through the biotope is provided by gravity feed to ensure the permanence of the facility.

7. Conclusions
Construction of this viaduct required conservation of the Matoba River environment and a short construction term. Selecting cantilever erection with precast segments as the construction method minimized the environmental impact. Through this project, many new ideas were tried in order to take conservation of the environment into consideration in construction. By efforts to maintain the Matoba river environment during construction, the habitat of fireflies was able to be sustained. In addition, by placing the biotope, we could expand the habitat of fireflies. More over, we told the younger generation the importance of the natural environment of the region. We would like to hope that the environment will be maintained in the future.

References