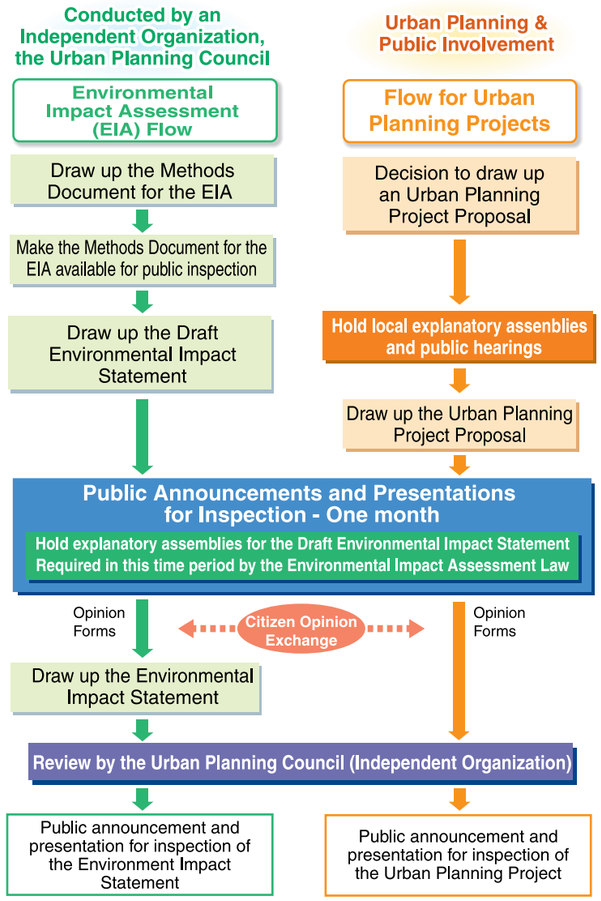
Flow Chart for Urban Planning Decisions



Contacts for information in regard to this pamphlet

In regard to urban planning:

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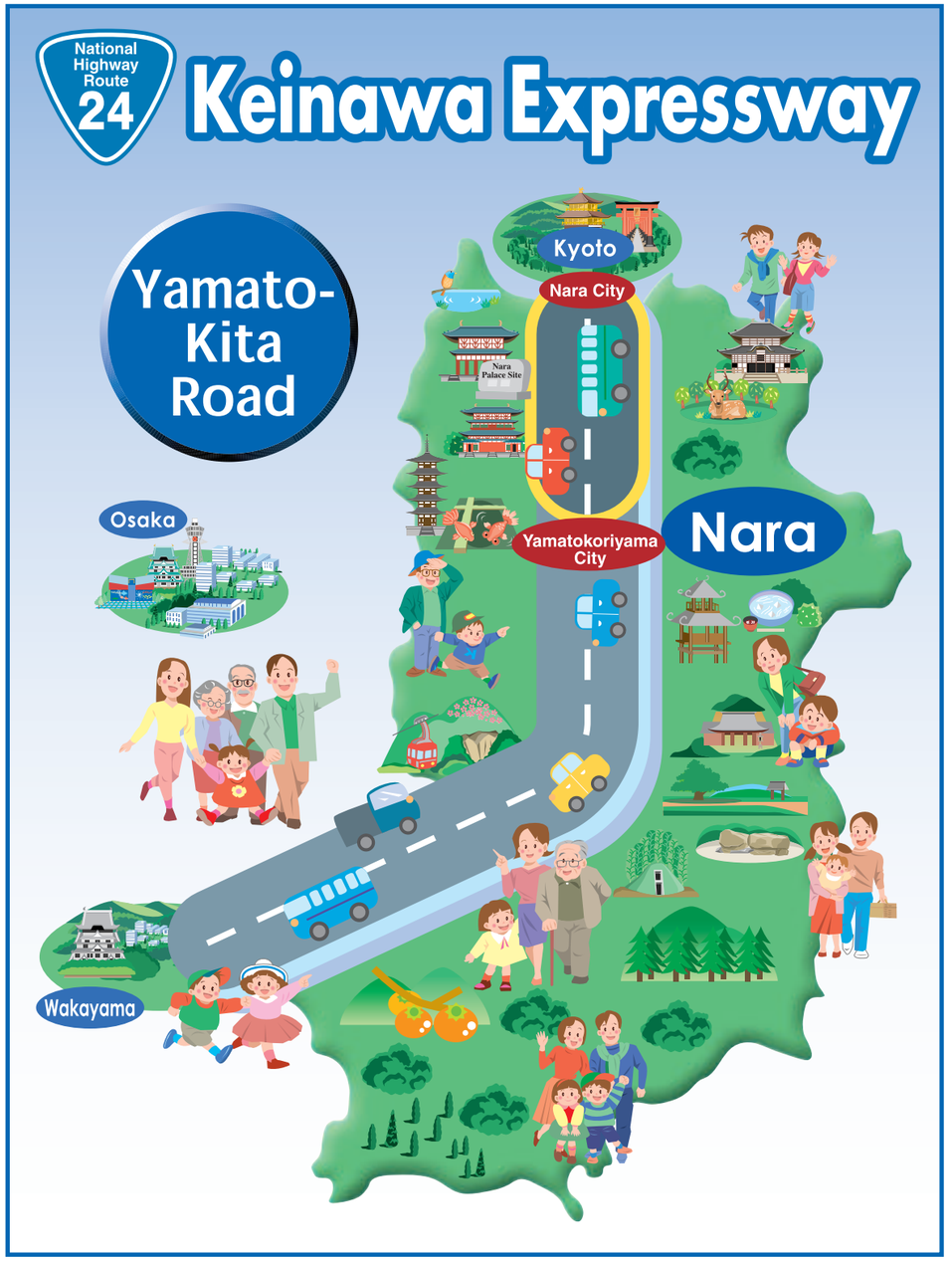
Yamatokoriyama City	City Planning Department, City Planning Section	Tel: 0743-53-1151
Tenri City	Construction Department, City Planning Division	Tel: 0743-63-1001
Kizugawa City	Construction Department, City Planning Division	Tel: 0774-72-0501

For information on works in progress, contact:

2nd Investigation Section, Nara National Highway Office,
Kinki Regional Development Bureau, Ministry of Land, Infrastructure and Transport · · · · · · · · · · Tel: 0742-33-1391

Yamato-Kita Road Environmental Impact Assessment Outline



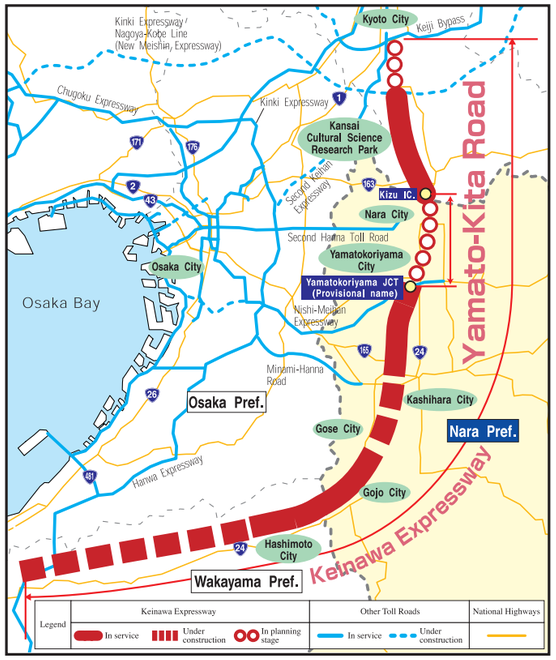
Ministry of Land, Infrastructure and Transport
Nara Prefecture, Nara City, Yamatokoriyama City, Tenri City,
Kyoto Prefecture, and Kizugawa City

Created in October, 2007

The Keinawa Expressway - Linking Local Districts and Creating a New Culture and Economic Interchange Zone

The Keinawa Expressway

When completed, the Keinawa Expressway will be a 120km-long high-standard trunk road running north and south across the Yamato Plains, strengthening connections along the Kyoto, Nara and Wakayama axis. The expressway will help to form a wide-area traffic network that will shorten the travel time required in the Kinki urban zone. Furthermore, within the local districts, the expressway will be the backbone highway providing support for the "Nara Half-day Traffic Zone and Highway Network Concept." On completion, the expressway will smooth the flow of traffic, mitigate congestion on National Highway Route 24, decrease the number of traffic accidents, reduce the amount of time required to reach destinations, assure regularity in traffic flow, and promote tourism across a wide area. Thus, the expressway will play an important role in the vitalization of the local districts.



The Keinawa Expressway and the Yamato-Kita Road

The Yamato-Kita Road will be a part of the Keinawa Expressway, including the sections of the expressway running from the Kizu Interchange to the Nishi-Meihan Expressway.

The Expected Results from the Construction of the Yamato-Kita Road

Nara City is the major base in Nara Prefecture for politics and the economy. There are many tourism resources in the vicinity, including a world heritage property, the "Historic Monuments of Ancient Nara." The construction of the Yamato-Kita Road will increase the accessibility of Nara City, making it easier to reach all of the cities from within the local districts and also from other prefectures. Therefore, the new expressway will vitalize the economy and promote the tourist industry over a wide area.

Furthermore, the new road will mitigate congestion on National Highway Route 24, decrease the number of accidents on other roads, improve medical care services, and function to improve the environment of the local district.

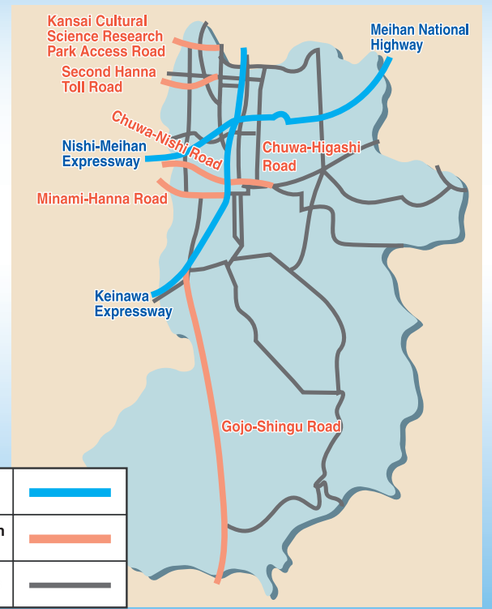
The Nara Half-day Traffic Zone and Highway Network Concept

Providing support for the urban planning efforts of Nara Prefecture, featuring the themes of "Prosperity, peace of mind, and latitude," this concept calls for the creation of a safe, smooth-flowing traffic network that will make it possible to reach any local district in Nara Prefecture within 2 hours and complete a round trip within half a day.

▼ Three Main Pillars to Realize The New Concept

- Construction of a network of trunk roads
- Countermeasures against congestion in the urban areas
- Construction of a roadside environment appropriate for the atmosphere of Nara

▼ Main Road Network



Flow Chart for Studies on the Yamato-Kita Road

- 1987 June — Based on a report by the Road Council, a plan was finalized for a 14,000 km traffic network composed of high-standard trunk roads.
- 1988 April — Route studies were initiated for the Yamato-Kita Road.
- 2001 July - 2002 March — **Groundwater Study Committee**
- 2002 March - 2002 July — **Cultural Properties Study Committee**
- 2002 September - 2003 October — **Expert Committee for Yamato-Kita Road**

A public involvement process (hereafter, PI process) was adopted, and discussions were continued, with constant input from the public, and a proposal was drafted in regard to the route selection and the road structure.

Main Contents of the Proposal

1. Two routes were selected, one with a tunnel under the Saikujo-Saho Line and an elevated roadway in other sections, and the other with a tunnel under National Highway 24 and an elevated roadway in other sections.
2. Of these two routes, it was considered that the "Saikujo-Saho Line" was superior, because it was further away from the Nara Palace Site.

PI Process

Inform the public of the project proposal
↓
Gathering opinions from the public
↓
Public announcement of the opinions
↓
Third-party council discussions

Further studies on the selected routes

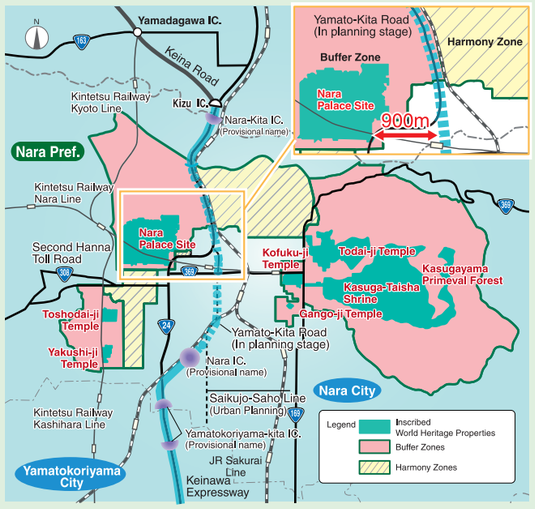
2006 February — **The Kinki District Trunk Roads Council, Discussions on the Yamato-Kita Road**
Further studies were conducted on the effects expected from the road construction, the proposed routes, and road structures, which led to the selection of the Saikujo-Saho Line, including a tunnel under the Saikujo-Saho Line and an elevated roadway in other sections.

- Environmental Impact Assessment Process
- Urban Planning Process

At present, we are at this stage.

Urban Planning Project Finalized

The World Heritage Property, the "Historic Monuments of Ancient Nara"



There are many cultural properties, including a world heritage property, in the northern part of Nara Prefecture. The planning for the Yamato-Kita Road includes studies and surveys based on the circumstances in each of the local districts.

The "Historic Monuments of Ancient Nara" are composed of eight separate cultural assets.

Structures considered national treasures or specified as historical properties:
Todai-ji Temple, Kofuku-ji Temple, Kasuga-Taisha Shrine, Gango-ji Temple, Yakushi-ji Temple, and Toshodai-ji Temple

Special historical properties or properties specified as special natural monuments:
The Nara Palace Site and the Kasugayama Primeval Forest

Establish two different types of sections in the areas near the "Historic Monuments of Ancient Nara"

Buffer Zones

The buffer zones were established as a direct measure to preserve the environment of the areas near the cultural properties. Three separate buffer zone regions were specified, the Kasugayama Hill Region, the Nara Palace Site Region, and the Nishi-no-Kyo Region.

Harmony Zones

The harmony zones also function to preserve the surrounding environment and also provide harmony with urban planning development projects. In order to provide integrated preservation for the eight cultural properties, a harmony zone has been constructed between each of the separate buffer zones.

Note: The lines showing the Yamato-Kita Road indicate the route of the roadway, not the road width. In addition, the details of the location and structure will be determined by the related authorities.

Kyoto Pref.
Kizugawa City
Kizugawa City Hall
Nara Kamo Line
Starting point
(Utahime-cho, Nara City, Nara Prefecture)
Nara Pref.
Kizu IC.
Keinawa Expressway (Keina Road)
Nara-Kita IC.
(Provisional name)
Yamadagawa IC.
Todai-ji Temple
Nara Prefectural Office
Kofuku-ji Temple
Gango-ji Temple
Saho River
Omori-Takabatake Line
Nara National Highway Office
Saikujo-Saho Line
Owada-Kidera Line
Nara City
Nara City Hall
Nara Palace Site
Nara IC.
(Provisional name)
Nara Yamatokoriyama Line
Kujo Line
Yamato-Kita Road L= Approx. 12.4 km
Terminal point
(Yokota-cho, Yamatokoriyama City, Nara Prefecture)
Tenri IC.
Tenri City
Nishi-Meihan Expressway
Yamatokoriyama JCT. - Koriyama IC.
Yamatokoriyama City
Yamatokoriyama-Kita IC.
(Provisional name)
Yamatokoriyama IC.
(Provisional name)
Saho River
Akishino River
Toshodai-ji Temple
Yakushi-ji Temple
Yamatokoriyama City Hall
N
1:40,000
0 1,000m 2,000m 3,000m 4,000m

Legend

- Yamato-Kita Road
- Underground sections
- Limited access highways
- National highways
- Main prefectural and municipal roads
- Main Urban Planning roads
- Interchanges (IC.)
- Junctions (JCT)
- Prefectural borders
- Municipal borders
- Prefectural offices
- City halls

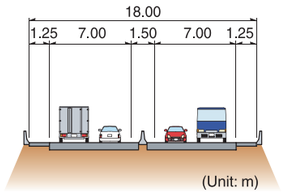
Standard Cross-section Views

Surface and Elevated Sections

[Surface sections]

Between the elevated and the underground sections

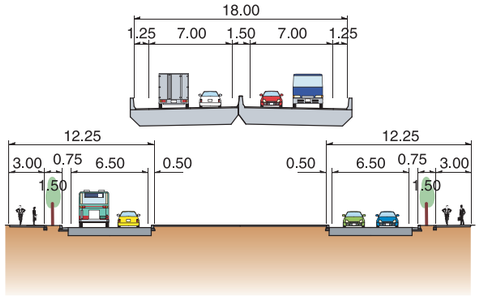
Length approx. 1.3 km



[Elevated sections]

All sections north of the Heijo Ohashi Bridge and all sections south of Karamomo-cho in Nara City

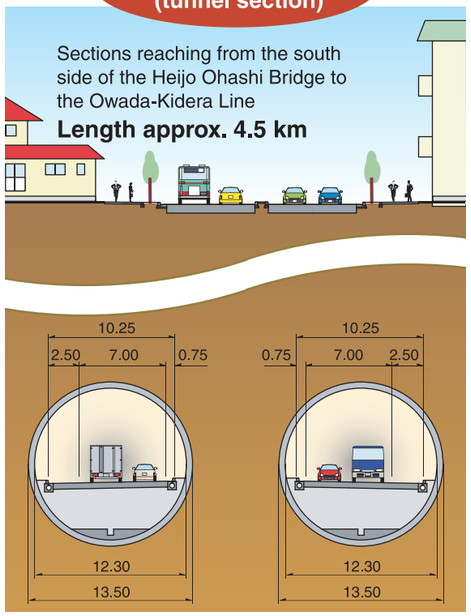
Length approx. 6.6 km



Underground Section (tunnel section)

Sections reaching from the south side of the Heijo Ohashi Bridge to the Owada-Kidera Line

Length approx. 4.5 km



Project Plan Details

Road length	Approx. 12.4 km	Road standard	1st type, 3rd class
Starting point	Utahime-cho, Nara City, Nara Pref.	Design speed	80 km/h
Terminal point	Yokota-cho,Yamatokoriyama City, Nara Pref.	No. of Lanes	4 lanes
		Design traffic volume	29.1 - 43.5 thousand vehicles/day

Connections and locations

Locations	Facilities (Provisional names)	Connections	Directions
Nara City	Nara-Kita Interchange	National Highway Route 24	Kyoto line exit Wakayama line entrance
	Nara Interchange	Urban Planning Road Saikujo-Saho Line Urban Planning Road Owada-Kidera Line Urban Planning Road Omori-Takabatake Line	Kyoto line entrance and exit Wakayama line entrance and exit
	Yamatokoriyama-Kita Interchange	Urban Planning Road Kujo Line National Highway Route 24	Kyoto line entrance and exit Wakayama line entrance and exit
Yamatokoriyama City	Yamatokoriyama Interchange	National Highway Route 24	Kyoto line entrance Wakayama line exit
	Yamatokoriyama Junction	Nishi-Meihan Expressway	To Matsubara and Tenri (Nishi-Meihan Expressway) To Wakayama (Yamato-Gose Road)

Prediction and Assessment Items

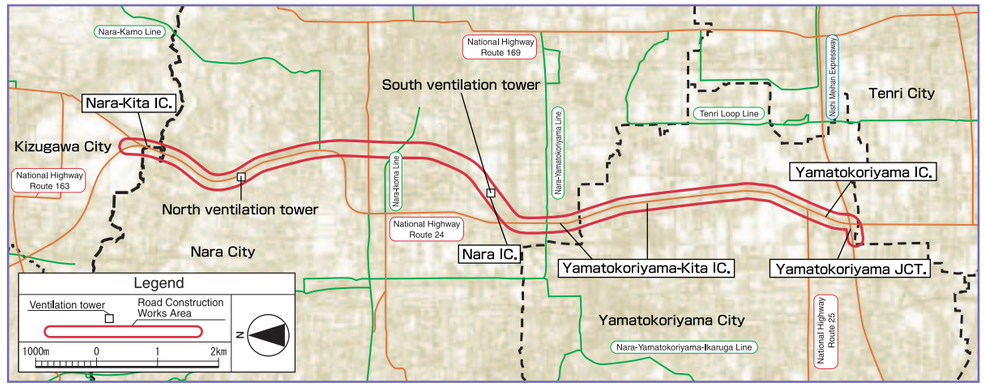
The items selected for predictions and assessments were those factors, including behavior, that might have an influence environment. The special characteristics of the local district were taken into consideration in the selection process, and then these items were presented to the public in the methods document for the environmental impact assessment. Opinions expressed by the citizens were also considered in the final selection process.

Predictions and assessment items / Environment impact factors	After completion			Construction works conducted
	Existing roads	Vehicles in transit	Existence & use of ventilation towers	
Quality of air		●	●	●
Damage due to strong winds			●	
Noise		●	●	●
Vibration		●		●
Law-frequency noise		●	●	
Topographical and geological features	●			●
Sunlight hindrance	●		●	
Fauna	●			●
Flora	●			●
Ecosystem	●			●
Landscape	●		●	●
Locations for contact with nature	●			●
Cultural properties	●	●	●	●
Waste material				●

Note : ● Indicates items predicted or assessed

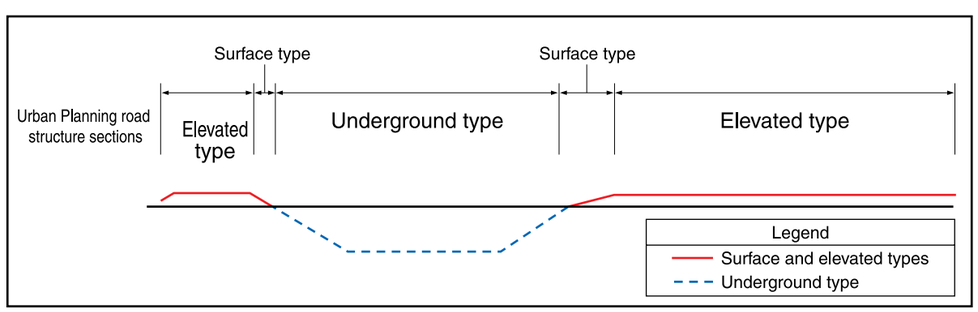
Plan Outline

Road Construction Works Area



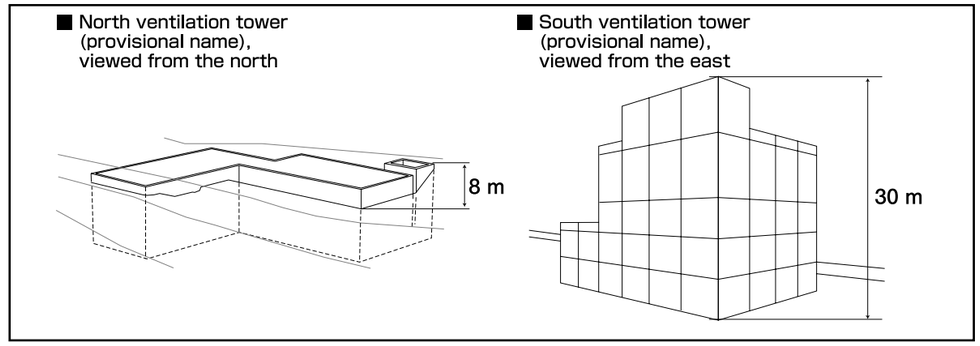
Note : The names of the interchanges (IC.), junctions (JCT.), and ventilation towers are provisional.

Vertical Cross Section

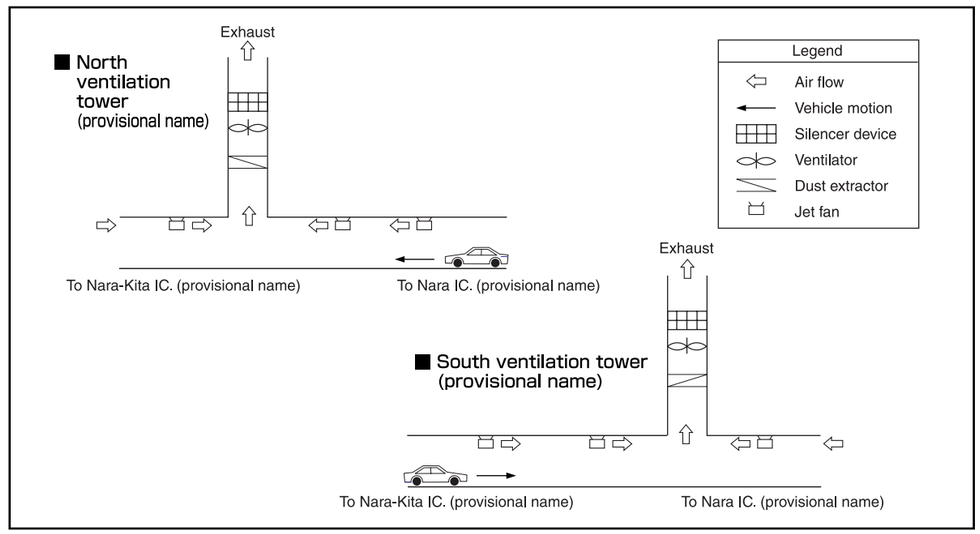


Outline of the Ventilation Towers

Outline configuration of the ventilation towers



Outline Illustration of the Tunnel Ventilation Method



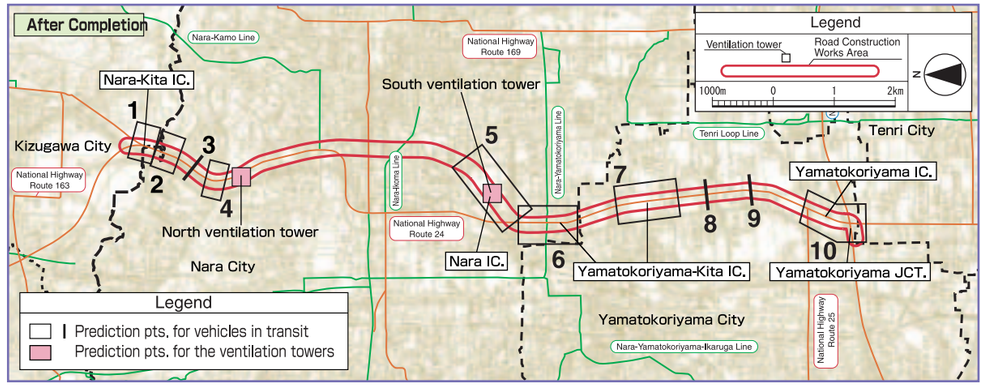
Design Traffic Volume

Sections	Design traffic volume (vehicles/day)
Nara-Kita IC. - Nara IC.	29,100
Nara IC. - Yamatokoriyama-Kita IC.	43,500
Yamatokoriyama-Kita IC. - Yamatokoriyama IC.-Yamatokoriyama JCT.	41,300

※ Note: The names of the interchanges (IC.) and junctions (JCT.) are provisional.

Quality of Air

Predictions were conducted on the effect on the quality of air due to vehicles in transit at ten study points, and also at two points for the north and south ventilation towers (one point for each tower). Furthermore, predictions were conducted on the effect due to the operation of construction equipment at six points, and on the effect due to vehicles employed in the construction works at four points.



Vehicles in Transit

The predictions were conducted for a height of 1.5 m above the ground surface. At the Sahodainishi-machi location (2) in Nara City, the road studied was an elevated road, with a middle-high class residential area along the roadway, and accordingly we employed a study height of 13.5 m at this site. The maximum predicted values for nitrogen dioxide (NO_2), suspended particle matter (SPM) and sulfur dioxide (SO_2) were 0.039 ppm, 0.071 mg/m^3, and 0.009 ppm, respectively, and all of these values were lower than the environmental criteria values.

No.	Prediction point	Height (m)	Daily average NO_2 values (98% annual values) (ppm)	Daily average SPM values (2% annual exclusion values) (mg/m^3)	Daily average SO_2 values (2% annual exclusion values) (ppm)
1	Ichisaka, Kizu Town (Kizugawa City)	1.5	0.039	0.071	0.008
2	Sahodainishi-machi, Nara City (1)	1.5	0.036	0.069	0.007
3	Sahodainishi-machi, Nara City (2)	1.5	0.034	0.068	0.007
		13.5	0.034	0.068	0.007
4	Saki-cho, Nara City	1.5	0.039	0.070	0.007
5	Hachijo-cho, Nara City	1.5	0.039	0.062	0.009
6	Saikujo-cho, Nara City	1.5	0.036	0.061	0.009
7	Shimomitsuhashi-cho, Yamatokoriyama City	1.5	0.037	0.063	0.009
8	Oe-cho, Yamatokoriyama City	1.5	0.037	0.063	0.009
9	Hatsushiin-cho, Yamatokoriyama City	1.5	0.036	0.063	0.009
10	Yokota-cho, Yamatokoriyama City	1.5	0.038	0.064	0.009
Environmental criteria			**0.04 ~ 0.06 or less**	**0.10 or less**	**0.04 or less**

Putting the Ventilation Towers Into Service

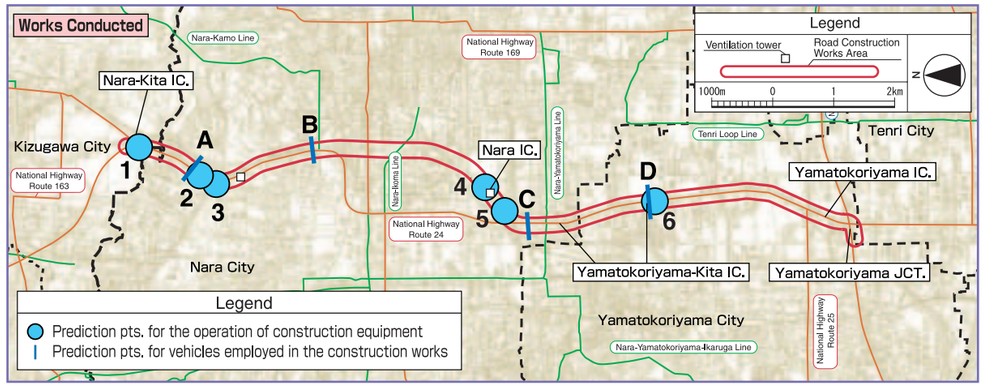
The maximum predicted values for nitrogen dioxide (NO_2), suspended particle matter (SPM) and sulfur dioxide (SO_2) were 0.032 ppm, 0.067 mg/m^3, and 0.009 ppm, respectively, and all of these values were lower than the enviromental criteria values.

Planned Facilities	Max. Conc. location			Nitrogen dioxide NO_2		Suspended particle matter SPM		Sulfur dioxide SO_2	
	Dir.	Height	Dist.	Concentration (ppm)	Daily average values (98% annual values) (ppm)	Concentration (mg/m^3)	Daily average values (2% annual exclusion values) (mg/m^3)	Concentration (ppm)	Daily average values (2% annual exclusion values) (ppm)
N. Ventilation tower	S.	1.5 m	300 m	0.000031	0.032	0.000004	0.067	0.000001	0.007
S. Ventilation tower	S.	1.5 m	380 m	0.000015	0.032	0.000002	0.059	0.000001	0.009
Environmental criteria				——	**0.04~0.06 or less**	——	**0.10 or less**	——	**0.04 or less**

Note: The maximum concentration location shows the direction and distance from the ventilation towers.

Environmental criteria

- **Nitrogen dioxide (NO_2):** *Environmental criteria for Nitrogen Dioxide* (July 11, 1978, Environment Agency Bulletin No. 25)
  The daily average value, obtained from hourly values, should be within the range of 0.04 ppm to 0.06 ppm, or less.
- **Suspended particle matter (SPM):** *Environmental Criteria for Atmospheric Pollution* (May 8, 1973, Environment Agency Bulletin No. 38)
  The daily average value, obtained from hourly values, should be 0.10 mg/m^3, or less.
- **Sulfur dioxide (SO_2):** *Environmental Criteria for Atmospheric Pollution* (May 8, 1973, Environment Agency Bulletin No. 38)
  The daily average value, obtained from hourly values, should be 0.04 ppm, or less.



Operation of Construction Equipment

No.	Prediction point	Height (m)	Dust, etc. (t/km^2/month)	Daily average NO_2 values (98% annual values) (ppm)	Daily average SPM values (2% annual exclusion values) (mg/m^3)
1	Ichisaka, Kizu Town (Kizugawa City)	1.5	6.8	0.037	0.069
2	Sahodainishi-machi, Nara City (1)	1.5	5.9	0.037	0.069
3	Sahodainishi-machi, Nara City (2)	1.5	2.5	0.036	0.068
4	Hachijo-cho, Nara City (1)	1.5	2.6	0.037	0.060
5	Hachijo-cho, Nara City (2)	1.5	7.0	0.035	0.060
6	Shimomitsuhashi-cho, Yamatokoriyama City	1.5	1.2	0.037	0.062
Environmental criteria and reference values			10 or less	**0.04 - 0.06 or less**	**0.10 or less**

The maximum predicted dust value was 7.0 t/km^2/month, which was lower than the reference value.
The maximum predicted nitrogen dioxide (NO_2) value was 0.037 ppm, lower than the environmental criteria value.
The maximum predicted value for suspended particle matter (SPM) was 0.069 mg/m^3, also lower than the environmental criteria value.

Vehicles Employed in the Construction Works

No.	Prediction point	Height (m)	Dust, etc. (t/km^2/month)	Daily average NO_2 values (98% annual values) (ppm)	Daily average SPM values (2% annual exclusion values) (mg/m^3)
A	Sahodainishi-machi, Nara City	1.5	0.2	0.034	0.068
B	Hokkeji-cho, Nara City	1.5	0.6	0.038	0.070
C	Karamomo-cho, Nara City	1.5	2.3	0.035	0.060
D	Shimomitsuhashi-cho, Yamatokoriyama City	1.5	1.6	0.041	0.066
Environmental criteria and reference values			10 or less	**0.04 - 0.06 or less**	**0.10 or less**

The maximum predicted dust value was 2.3 t/km^2/month, lower than the reference value.
The maximum predicted nitrogen dioxide (NO_2) value was 0.041 ppm, lower than the environmental criteria value.
The maximum predicted value for suspended particle matter (SPM) was 0.070 mg/m^3, also lower than the environmental criteria value.

Environmental criteria

- **Nitrogen dioxide (NO_2):** *Environmental criteria for Nitrogen Dioxide* (July 11, 1978, Environment Agency Bulletin No. 25)
  The daily average value, obtained from hourly values, should be within the range of 0.04 ppm to 0.06 ppm, or less.
- **Suspended particle matter (SPM):** *Environmental Criteria for Atmospheric Pollution* (May 8, 1973, Environment Agency Bulletin No. 38)
  The daily average value, obtained from hourly values, should be 0.10 mg/m3, or less.

Reference value

- **Dust, etc.:** *Technical Methods for Road Environmental Impact Assessment (No 1.)* Oct. 2000, Ministry of Land, Infrastructure and Transport, Public Works Research Institute, falling dust volume; 10t/km2/month

Technical Terms

ppm (parts per million): This unit shows the ratio of minute particles of matter in the atmosphere. For example, if 1 cm^3 of matter is included in 1 m^3 of the atmosphere, the concentration would be 1 ppm. (Reference: JIS K 0050 *General Rules for Chemical Analysis Methods*)

Daily average values (98% annual value): Daily average value for the day at 98% of the annual values, counting from the lower daily values (ppm)
(Reference: *Revisions of Environmental Criteria for Nitrogen Dioxide*, July 7, 1982, Kandaiki, Edition No. 262)

Daily average values (2% annual exclusion value): Daily average value for the day at 2% of the annual values, exclusion value counting from the larger daily values (ppm)
(Reference: *Environmental Criteria for Atmospheric Pollution*, June 12, 1973, Kandaiki, Edition No.143)

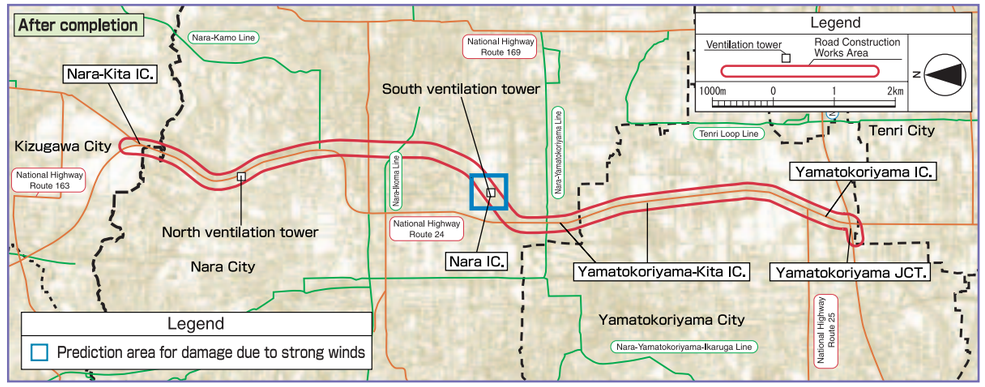
Suspended particle matter (SPM): SPM is a term for minute particles suspended in the atmosphere 10 μm or smaller in diameter.
(Reference: *Environmental Criteria for Atmospheric Pollution*, May 8, 1973, Environment Agency Bulletin No. 38)

Environmental criteria: Criteria considered important to maintain for the protection of health
(Reference: *Environmental Criteria for Atmospheric Pollution*, May 8, 1973, Environment Agency Bulletin No. 38)

Damage Due to Strong Winds

The south ventilation tower was selected for the prediction of damage due to strong winds because this becomes a factor to consider when buildings are constructed that are 5-6 times the height of the average building in the vicinity.

The prediction range was set to 100meters, about three times height of the south ventilation tower, and predictions were conducted at eight prediction points along the road.



The predicted values for damage due to strong winds were as follows. The ratios of the number of days with a daily maximum average wind velocity of 5.0 m/s, 7.5 m/s, and 10.0 m/s or more were 12.9% (48 days/year), 1.1% (5 days/year), and 0%, respectively, all of which were lower than the reference values.

Wind velocity (m/s)	Before construction (%)	Prediction results (frequency) for when the daily maximum average wind velocity exceeds the reference value (%)								Reference values (%)
		Prediction point								
		1	2	3	4	5	6	7	8	
5.0 or more	7.7	4.3	8.3	12.9	11.4	6.6	8.0	5.4	6.6	22 or less
7.5 or more	0.3	0.3	0.6	1.1	0.6	0.0	0.3	0.6	0.0	3.6 or less
10.0 or more	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6 or less

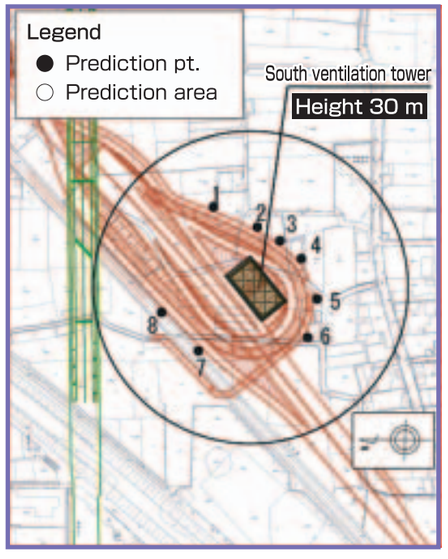
Reference values

- Based on the *Technical Methods for Road Environmental Impact Assessment* (*No 3.*) (Oct. 2000, Ministry of Land, Infrastructure and Transport, Public Works Research Institute) "Excessive frequencies of permissible daily maximum average wind velocity."

Space usage	Excessive frequencies of permissible daily maximum average wind velocity		
	5.0m/s or more	7.5m/s or more	10.0m/s or more
Residential area	22% or less (80 days)	3.6% or less (13 days)	0.6% or less (2 days)

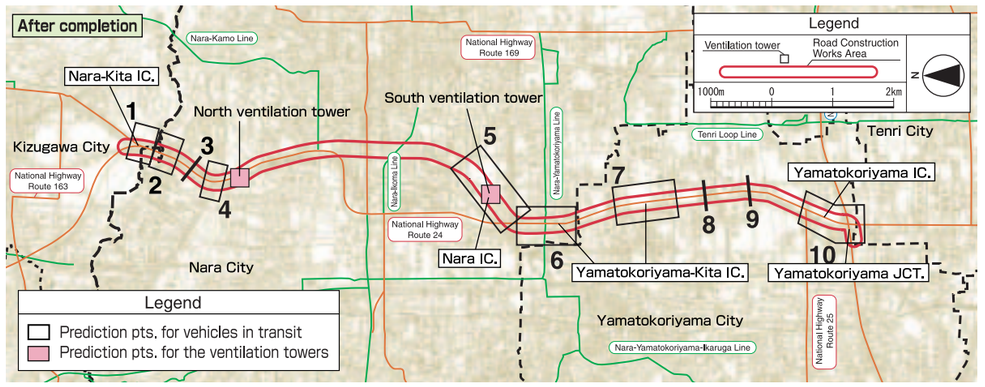
(Note) Considering the usage of land in the district, it was considered appropriate to use values for a residential area.

Reference: Shuzo Murakami, Yoshiteru Iwasa, et al., *Research on wind environmental studies and assessment standards*, Architectural Institute of Japan, Thesis Collection No. 325, pp.74-84 (March 1983)



Noise

Noise due to vehicles in transit was predicted at 10 points, and also at two points for the north and south ventilation towers (one point for each tower, assuming that the towers were in service). Furthermore, predictions were conducted on the effect due to the operation of construction equipment at six points, and on the effect due to vehicles employed in the construction works at four points.



Vehicles in Transit

We conducted predictions in two stages at heights of 1.2 and 4.2 meters in the lower level residential areas. Furthermore, in the Sahodainishi-machi (2) area, the subject road way was an elevated road structure, and the surrounding area is a middle-high class residential area, so we also conducted predictions at a height of 28.2 meters.

In regard to the prediction of noise at the border between govenment facilities and public areas (border points), if it is considered necessary, sound insulation barriers will be constructed, as an environmental preservation measure, to control the sound levels to 70 dB during the day and 65 dB at night, both of which are lower than the environmental criteria values.

For the prediction of noise areas behind the highway (rear areas), if it is considered necessary, sound insulation barriers will be constructed, as an environmental preservation measure, to control the sound levels to 65 dB during the day and 60 dB at night, both of which are lower than the environmental criteria values.

No.	Prediction point	Height (m)	Prediction results at border points (dB) LAeq		Environmental criteria (dB) LAeq		Predictions in rear areas (dB) LAeq		Environmental criteria (dB) LAeq	
			day	night	day	night	day	night	day	night
1	Ichisaka, Kizu Town (Kizugawa City)	4.2	70	65	70	65	59	55	65	60
		1.2	59	54			58	53		
2	Sahodainishi-machi, Nara City (1)	4.2	70	65			61	56		
		1.2	68	63			59	54		
3	Sahodainishi-machi, Nara City (2)	28.2	69	64			65	60		
	Sakyo, Nara City	4.2	65	61			65	60		
		1.2	65	61			65	60		
4	Sahodainishi-machi, Nara City (3)	4.2	68	63			65	60		
		1.2	62	58			62	57		
5	Hachijo-cho, Nara City	4.2	70	65	(70)	(65)	63	59	(65)	(60)
		1.2	61	56			60	55		
6	Saikujo-cho, Nara City	4.2	69	64	70	65	62	58	65	60
		1.2	62	58			59	55		
7	Shimomitsuhashi-cho, Yamatokoriyama City	4.2	69	64	(70)	(65)	62	57	(65)	(60)
		1.2	64	59			59	55		
8	Oe-cho, Yamatokoriyama City	4.2	69	64			64	59		
		1.2	67	62			61	57		
9	Hatsushiin-cho, Yamatokoriyama City	4.2	70	65			63	59		
		1.2	66	61			61	56		
10	Yokota-cho, Yamatokoriyama City	4.2	70	65			64	60		
		1.2	69	65			64	59		

Note : In regard to land areas not specified in the environmental criteria district specifications, the present land use was considered and the land was specified as a "B district." The assumed values are shown in parentheses.

Environmental criteria

- **Border areas:** Criteria values for areas in contact with roadways handling trunk road traffic, based on the *Environmental Criteria for Noise Pollution* (Sep. 30, 1998, Environment Agency Bulletin No.64).

Day (6am - 10pm)	Night (10pm - 6am)
70 dB or less	65 dB or less

- **Rear areas:** Criteria values for B (2 lanes or more) and C districts*, included in the Districts in contact with roadways specification, based on *the Environmental Criteria for Noise Pollution* (Sep. 30, 1998, Environment Agency Bulletin No. 64).

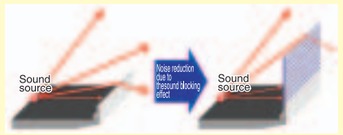
Day (6am - 10pm)	Night (10pm - 6am)
65 dB or less	60 dB or less

※B districts are defined as "Mainly residential districts (Type 1, 2 and Semi-residential districts)," and C districts are defined as "Industrial and business districts with a considerable number of residents (local and other business districts, semi-industrial and industrial districts)."

Noise

Environmental Preservation Measures

Sound insulation barriers at a height of one to eight meters will be constructed as an environmental preservation measure for vehicles in transit on the roadway. These barriers effectively block the transmission of sound and reduce noise.



Technical Terms

Border areas: Land areas in contact with the roadway area.
Rear areas: Points 20 m away from the border between government facilities and public areas.

Putting the Ventilation Towers Into Service

The maximum predicted noise at the north and south ventilation towers were 37 and 38 dB, respectively, which were lower than the regulatory criteria for specified plant facilities.

Environmental criteria

Criteria values for nighttime included in the *Regulatory Criteria for Specified Plant Facilities in Regulated Districts* (March 29, 2005, Nara City Bulletin No. 171) for Type 1* and Type 2* districts.

District classification	daytime	morning/evening	nighttime
Type 1 districts	50 dB	45 dB	40 dB
Type 2 districts	60 dB	50 dB	45 dB

District classifications: morning (6am - 8am), daytime (8am - 6pm), evening (6pm - 10pm), and night (10pm - 6am)

※ **Type 1 districts:** Exclusive Type 1 and Type 2 lower classification residential districts、exclusive Type 1 and Type 2 middle-high classification residential districts, exclusive Type 1 and Type 2 residential districts, scenic districts (excluding nearby business districts, commercial districts, semi-industrial districts), and historical atmosphere preservation districts.

Type 2 districts: Type 1 and Type 2 residential districts, semi-residential districts (excluding those that correspond to Type 1 districts), general-pupose districts and districts that do not include any historical atmosphere preservation districts.

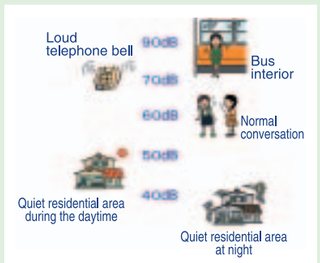
Technical Terms

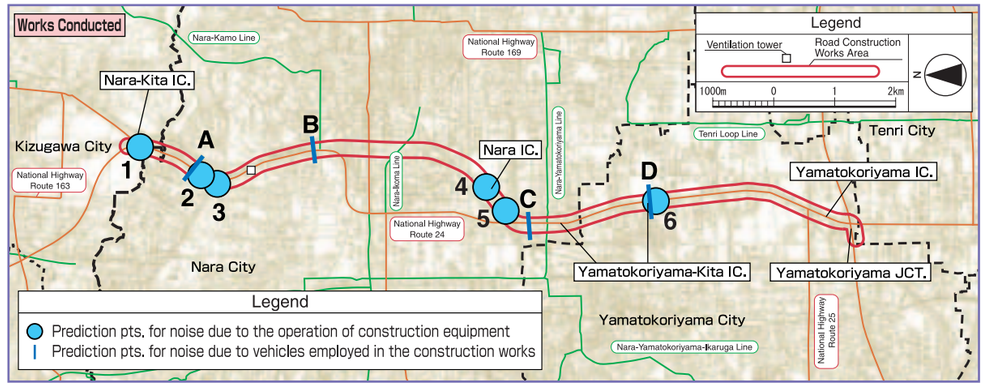
dB (decibel): This unit expresses the size of sound or vibration.
Normal conversation is about 60 dB.
About 40 dB is normal for a quiet residential area at night.

LAeq: When the noise level varies for a time period, this unit shows the energy input as an average noise level over time during the measurement period. (equivilent noise level)

L A 5 : Noise values varying over time are read, and arranged from the high values down to the lower values. This unit shows the value at 5% of that range of values, counting down from the higher values.
(Reference: JIS Z 8731 *Expressing and measuring environmental noise pollution*)

(Reference: *Laws, regulations and technology for the prevention of environmental pollution (noise pollution),* Editorial Committee for laws, regulations and technology for the prevention of environmental pollution)
(Reference: *Noise Pollution in Daily Life - Present Situation and Future Themes,* Ministry of the Environment)





Operation of Construction Equipment

Through the construction of sound insulation barriers as an environmental preservation measure, the maximum predicted noise value was 85 dB, lower than the regulatory criteria value for noise at specified construction works.

No.	Prediction points	Height (m)	Prediction results (dB) LA5	Environmental criteria (dB) LA5
1	Ichisaka, Kizu Town (Kizugawa City)	4.2	80	(85)
		1.2	81	
2	Sahodainishi-machi, Nara City (1)	7.2	78	85
		4.2	80	
		1.2	81	
3	Sahodainishi-machi, Nara City (2)	4.2	80	
		1.2	81	
4	Hachijo-cho, Nara City (1)	4.2	80	
		1.2	81	
5	Hachijo-cho, Nara City (2)	4.2	80	
		1.2	81	
6	Shimomitsuhashi-cho, Yamatokoriyama City	4.2	85	
		1.2	77	

Note: For prediction points in districts not falling under the regulatory criteria for noise at specified construction works, we used criteria based on the land use in the area. These values are shown in parentheses.

Environmental criteria

The criteria specified in the *Criteria for the Regulation of Noise Generated During Specified Construction Works* (Nov. 27, 1968, the Ministry of Health, Labour, and Welfare and the Ministry of Land, Infrastructure and Transport Bulletin No. 1) is 85 dB or less.

Environmental Preservation Measures

As an environmental preservation measure against noise due to the operation of construction equipment, 2-meter high sound insulation barriers will be constructed at each prediction point.

Vehicles Employed in the Construction Works

The maximum predicted noise value was 76 dB, and while there were some places where the value exceeded the environmental criteria value for noise, there is no possibility of the level of the noise increasing at the on-site locations.

No.	Prediction point	Height (m)	On-site values (dB) LAeq	Prediction results (dB) LAeq	Environmental Criteria (dB) LAeq
A	Sahodainishi-machi, Nara City	1.2	55	55	70
B	Hokkeji-cho, Nara City	1.2	72	72	
C	Karamomo-cho, Nara City	1.2	66	66	(70)
D	Shimomitsuhashi-cho, Yamatokoriyama City	1.2	76	76	

Note: Shimomitsuhashi-cho, Yamatokoriyama City and Karamomo-cho, Nara City are not specified in the environmental district specifications, and the values for these areas are indicated in parentheses.

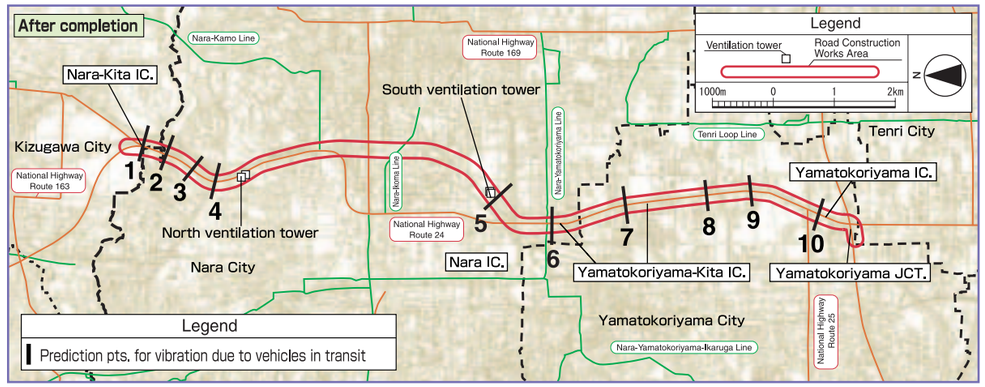
Environmental criteria

Criteria values for areas in contact with roadways handling trunk road traffic, based on the *Environmental Criteria for Noise Pollution* (Oct. 30, 1998, Environment Agency Bulletin No. 64).

Day (6am - 10pm)
70 dB or less

Vibration

Predictions for vibration due to vehicles in transit were conducted at 10 prediction points.
Furthermore, predictions were conducted for vibration due to the operation of construction equipment at six points, and for vibration due to vehicles employed in the construction works at 4 points.



Vehicles in transit

The maximum predicted value for vibration was 51 dB in the daytime and 50 dB in the nighttime, both of which were lower than the limit values set for roadway traffic vibration.

No.	Prediction points	Prediction results (dB) L10		Environmental criteria (dB) L10	
		daytime	nighttime	daytime	nighttime
1	Ichisaka, Kizu Town (Kizugawa City)	45	45	(65)	(60)
2	Sahodainishi-machi, Nara City (1)	47	46	65	60
3	Sahodainishi-machi, Nara City (2)	46	46	70	65
4	Sahodainishi-machi, Nara City (3)	51	50	65	60
5	Hachijo-cho, Nara City	50	49		
6	Saikujo-cho, Nara City	48	48		
7	Shimomitsuhashi-cho, Yamatokoriyama City	50	50		
8	Oe-cho, Yamatokoriyama City	50	50		
9	Hatsushiin-cho, Yamatokoriyama City	50	49		
10	Yokota-cho, Yamatokoriyama City	50	49		

Note: Considering the land use in the district, the prediction points not classified for roadway traffic vibration in the Vibration Regulation Law were assigned a "Type 1 district" classification. These values are shown in parentheses.

Environmental criteria

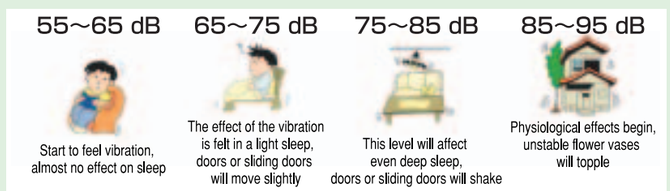
The limits of roadway traffic vibration, based on the regulations listed in the Vibration Regulation Law (June 10, 1976, Law No. 64), Article 16, Item 1.

District classification	daytime (8am - 7pm)	nighttime (7pm - 8am)
Type 1 districts*	65 dB	60 dB
Type 2 districts*	70 dB	65 dB

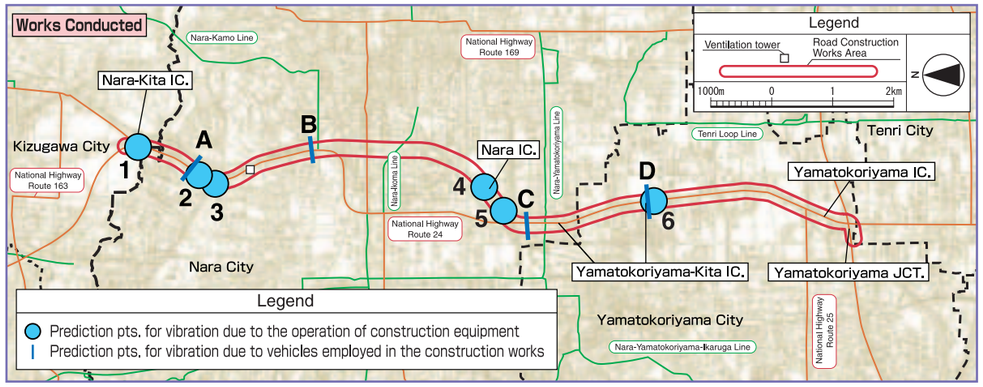
※**Type 1 districts:** Exclusive Type 1 and Type 2 lower classification residential districts, exclusive Type 1 and Type 2 middle-high classification residential districts, exclusive Type 1 and Type 2 residential districts, semi-residential districts and districts with no classification.
Type 2 districts: Nearby business districts, commercial districts, semi-industrial districts and industrial districts.

Technical Terms

dB(decibel) This unit is used to express the strength of sound and vibration.
Vibration can be felt at about 55 - 65 dB.
(Reference: JIS Z 8735 Methods for measuring vibration levels)



(Reference: *Technical manual for vibration regulations*, Environment Agency, Atmosphere Conservation Bureau, Special Pollution Division)



Operation of Construction Equipment

The maximum predicted vibration value was 72 dB, lower than the regulatory criteria value for viberation at specified construction works.

No.	Prediction points	Prediction results (dB) L10	Environmental criteria (dB) L10
1	Ichisaka, Kizu Town (Kizugawa City)	69	(75)
2	Sahodainishi-machi, Nara City (1)	68	75
3	Sahodainishi-machi, Nara City (2)	69	
4	Hachijo-cho, Nara City (1)	65	
5	Hachijo-cho, Nara City (2)	69	
6	Shimomitsuhashi-cho, Yamatokoriyama City	72	

Note: For prediction points in districts not falling under the regulatory criteria for vibration at specified construction works, we used criteria based on the land use in the area.
These values are shown in parentheses.

Environmental criteria

The regulations for vibration occuring in specified construction works, based on the regulations listed in the Vibration Regulation Law (June 10, 1976, Law No. 64), Article 15, Item 1. Criteria - 75 dB or less.

Vehicles Employed in the Construction Works

The maximum predicted vibration was 44 dB, lower than the limit values specified for vibration due to roadway traffic.

No.	Prediction points	On-site value (dB) L10	Prediction results (dB) L10	Environmental criteria (dB) L10
A	Sahodainishi-machi, Nara City	30	30	70
B	Hokkeji-cho, Nara City	38	38	65
C	Karamomo-cho, Nara City	41	41	
D	Shimomitsuhashi-cho, Yamatokoriyama City	43	44	

Environmental criteria

The limits of roadway traffic vibration, based on the regulations listed in the Vibration Regulation Law (June 10, 1976, Law No. 64), Article 16, Item 1.

District classification	daytime (8am - 7pm)
Type 1 districts*	65 dB
Type 2 districts*	70 dB

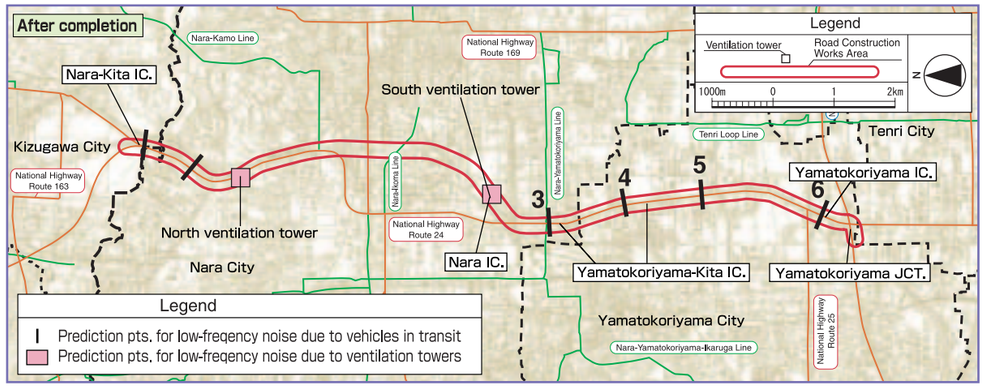
※**Type 1 districts:** Exclusive Type 1 and Type 2 lower classification residential districts, exclusive Type 1 and Type 2 middle-high classification residential districts, exclusive Type 1 and Type 2 residential districts, semi-residential districts and districts with no classification.
Type 2 districts: Nearby business districts, commercial districts, semi-industrial districts and industrial districts.

Technical Terms

L10: Vibration varying over time is read and arranged in order from the largest to the smallest values.
This value corresponds to the value at 10%, counting down from the largest value.
(Reference: JIS Z 8735 Methods for measuring vibration levels)

Low-freqency Noise

Low-freqency noise due to the transit of vehicles was predicted at 6 prediction points, and that due to the ventilation towers was predicted at 2 points, one each for the north and south ventilation towers.



Vehicles in Transit

The maximum predicted subsonic L_{50} and L_{G5} values were 76 dB and 84 dB, respectively, lower than the reference values.

No.	Prediction points	Prediction results (dB)		Reference values (dB)	
		L_{50}	L_{G5}	L_{50}	L_{G5}
1	Ichisaka, Kizu Town (Kizugawa City)	64	73	90	100
2	Sahodainishi-machi, Nara City	71	79		
3	Saikujo-cho, Nara City	76	84		
4	Shimomitsuhashi-cho, Yamatokoriyama City	73	81		
5	Oe-cho, Yamatokoriyama City	74	82		
6	Yokota-cho, Yamatokoriyama City	71	80		

Putting the Ventilation Towers Into Service

The maximum predicted subsonic L_{50} and L_{G5} values were 88 dB and 90 dB, respectively, lower than the reference values.

Prediction points	Height	Exhaust tower - prediction point distance (m)	Prediction results (dB)		Reference values (dB)	
			L_{50}	L_{G5}	L_{50}	L_{G5}
N. ventilation tower vicinity	1.2 m	10	88	90	90	100
S. ventilation tower vicinity	1.2 m	41	76	78		

Reference values:

The values shown below were based on *Technical Methods for Road Environmental Impact Assessment (No. 2)* (April, 2004 Ministry of Land, Infreastructure and Transport, National Institute for Land and Infrastructure Management)

- Low-frequency noise pressure levels in an ordinary environment ——— L_{50} : 90 dB or less
- Special G low-frequency noise pressure levels specified in ISO7196 ——— L_{G5} : 100 dB or less

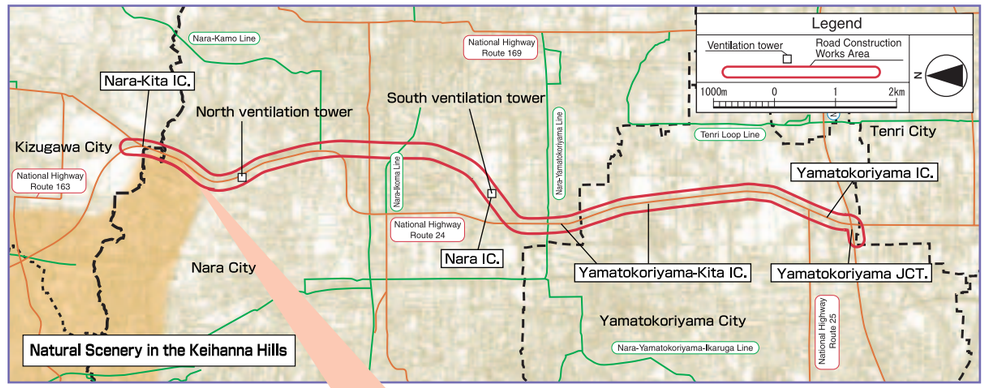
Technical Terms

L_{50}: The 50% time ratio sound pressure in the range of 1~80 Hz, as the central value of all measurements obtained within this range

L_{G5}: Special G low-frequency noise 5% time ratio sound pressure in the range of 1~20 Hz, the value corresponding to 5%, counting down from the largest value for all of the measured values obtained within this range.
(Reference: *Technical Methods for Road Environmental Impact Assessment (No. 2)* (April, 2004 Ministry of Land, Infrastructure and Transport, National Institute for Land and Infrastructure Management)

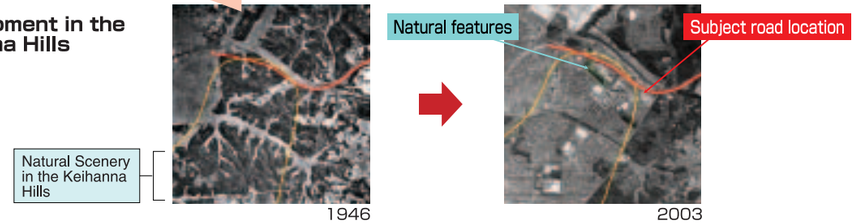
Topographical and Geological Features

Predictions were conducted for the geological features and soil quality in the "Natural Scenery in the Keihanna Hills" area, considered an important geological feature of the district.



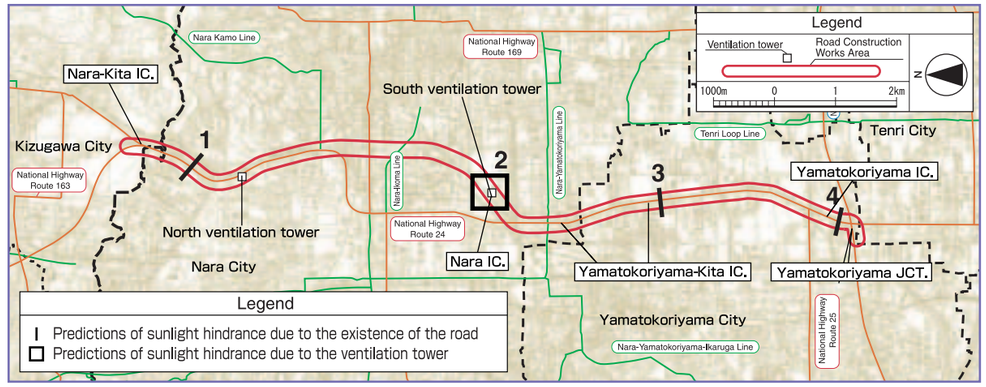
In regard to the land formations in the peripheries of the road construction works area, the active structures in the Keihanna Hills overlaps the road construction works area, and large-scale residential development has been conducted. Furthermore, the JR Kansai Line and National Highway Route 24 run through the area, therefore the subject road construction works will not alter the typical formations, which characterize the important land formations. Furthermore, there will be no alterations to the natural land formations.

Development in the Keihanna Hills



Sunlight Hindrance

Predictions of sunlight hindrance were conducted at four points, all at locations near the closest residences.



The maximum predicted value for the number of hours of sunlight hindrance due to the existence of an elevated roadway and a ventilation tower was 1.5 hours, lower than the reference value.

No.	Prediction point	No. of hr. of shade due to elevated structures and ventilation towers	Reference value
1	Sahodainishi-machi, Nara City	0 hr.	5 hr. in 2 stages
2	Hachijo-cho, Nara City	0 hr.	
3	Minosho-cho, Yamatokoriyama City	1.3 hr.	
4	Izushichijo-cho, Yamatokoriyama City	1.5 hr.	

Reference values:

Reference: Based on *Technical Methods for Road Environmental Impact Assessment (No. 3)* (Oct., 2000, Ministry of Land, Infrastructure and Transport, National Institute for Land and Infrastructure Management), the value specified in "The cost burden for environmental damage due to shade caused by the construction of public facilities."

Fauna

Among the animals existing in the area, according to the literature on the subject and on-site studies, local laws, etc., have specified 167 important species of animals in the road construction works and its peripheries. Of these animals, only the northern goshawk species has been specified as a subject for preservation.

Sections of the natural habitat of the northern goshawk have disappeared, decreased in size or been divided, and as a preservation measure, the habitat will be cultivated through tree planting in the area alongside of the roadway. More of the existing species in the area will also be planted, and low-noise construction equipment will be employed. Furthermore, follow-up studies will be conducted to monitor the reproduction situation, etc.

Classification	Preservation subject	Environmental preservation measures
Aves	Northern goshawk	**Planting along the roadway, planting of existing species, use of low-noise construction equipment**

Flora

Among the plants existing in the area, according to the literature on the subject and on-site studies, local laws, etc., have specified 38 important species in the road construction works and its peripheries. Among these, magnolia kobus, thoroughwort, carex phacota Sprengel and pampas grass were the plants specified as the subject of preservation.

Studies will be conducted on preservation measures for magnolia kobus, which is considered to alter the natural habitat, including transplantation works.

Furthermore, for thoroughwort, carex phacota Sprengel and pampas grass, for which it may be considered that the habitat has been lost or decreased, studies will be conducted on preservation measures, including transplantation works, and the construction yards and equipment parking facilities on access roads employed for the construction works will be limited to the minimum. In addition, follow-up studies will be conducted to monitor the transplanted plants.

Classification	Preservation subject	Environmental preservation measures
Vascular plants	magnolia kobus	**Studies on preservation measures, including transplantation (including the opinion of experts)**
	thoroughwort	**Minimization of construction yards and equipment parking facilities on access roads Studies on preservation measures for important species, including transplantation (including the opinion of experts)**
	carex phacota Sprengel	
	pampas grass	

Ecosystem

The study results on animals and plants were organized into three classifications, hill forests, arable land, and open water, and eight ecosytems composed of species requiring attention and biocenological groups characteristic of the local districts were established.

Among these groups, only one species, the northern goshawk, was the subject of preservation measures.

Sections of the natural habitat of the northern goshawk have disappeared, decreased in size or been divided, and as a preservation measure, the habitat will be cultivated through tree planting in the area alongside of the roadway. More of the existing species in the area will also be planted, and low-noise construction equipment will be employed. Furthermore, follow-up studies will be conducted to monitor the reproduction situation, etc.

Classification	Preservation subject	Environmental preservation measures
Ecosystem of hill forests	Northern goshawk	**Planting along the roadway, planting of existing species, use of low-noise construction equipment**

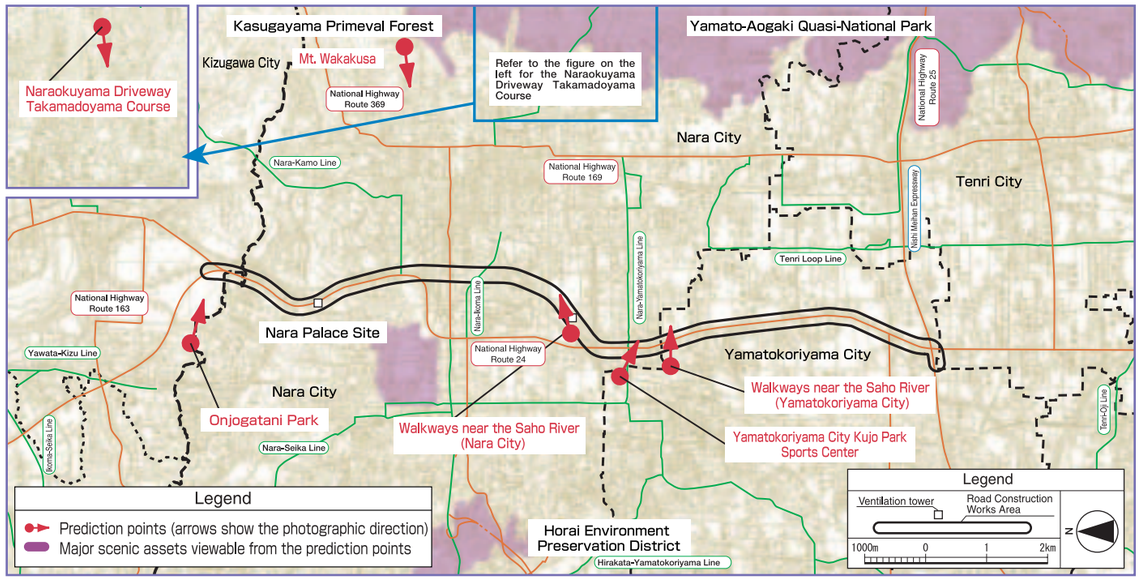
TECHNICAL TERMS

Criteria for the selection of important species: Species specified in the following laws, or mentioned in the literature were taken as the important species.

1. Natural monuments specified in the Law for Protection of Cultural Properties (1950, Law No. 214) and the Bylaws for Protection of Cultural Properties of the Prefectures, Cities and Towns
2. The Law for the Conservation of Endangered Species of Wild Fauna and Flora (1992, Law No. 75)
3. Revision: *Endangered Wildlife Species in Japan - Red Data Book* (Ministry of the Environment)
4. *Kinki Region Avian Red Data Book - Development of a System for the Determination of Endangered Species* (2002, Kyoto University Press)
5. *Red List for Avian Species (2000, Ministry of the Environment, press material)*
6. *Red List for Reptiles and Amphibians (2000, Ministry of the Environment, press material)*
7. *Red List for Spiders and Crustaceans (2000, Ministry of the Environment, press material)*
8. *Plant Community Red Data Book* (1996, Important Plant Species for Preservation in Japan and the Plant Community Branch of the Plant Community Study Committee)
9. Revision: *Important Plant Species for Preservation in the Kinki Region - Red Data Book Kinki 2001* (2001, Red Data Book Kinki Study Committee)
10. *The Wild Animals of Nara Prefecture that Need Care (vertebrate animals) A Selection of Species by Nara Prefecture* (Nara Prefecture, 2005 Press Materials)
11. *Kyoto Prefecture Red Data Book* (2002, Kyoto Prefecture)
12. *Natural Monuments Emergency Study Flora Diagrams and Main Plants and Animals Map-26. Kyoto Prefecture* (1976, Agency for Cultural Affairs)
    Natural Monuments Emergency Study Flora Diagrams and Main Plants and Animals Map-29. Nara Prefecture (1975, Agency for Cultural Affairs)
13. *2nd Natural Environment Conservation Foundation Study, Special Plant Communities Study Report* (1979, Nara Prefecture) 2nd Natural *Environment Conservation Foundation Study, Special Plant Communities Study Report* (1979, Kyoto Prefecture)
    3rd Natural Environment Conservation Foundation Study, Important Plant Communities in Japan II (1998, Environment Agency)
14. Nara Prefecture Natural Environment Conservation Bylaws (1972, Nara Prefectural Bylaw No. 26)
15. *Nara Prefecture Environmental Resources Data Book - The Animals, Plants, Geology, Soil Quality, and Cultural Properties, etc.* (1998, Nara Prefecture)

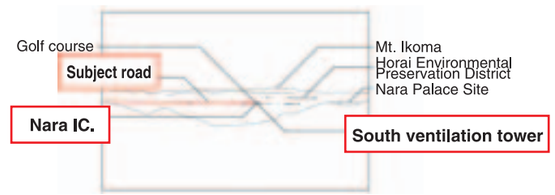
Landscape

Viewpoints from which scenic assets can be seen with the naked eye were considered the main important viewpoints, and studies were conducted on whether or not the subject road could be seen from these viewpoints. Predictions were conducted at 6 points on the extent of alterations in the major scenic landscapes.



Naraokuyama Driveway Takamadoyama Course

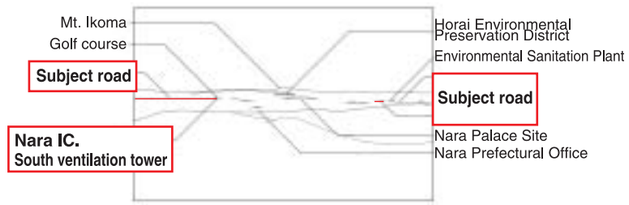
Law visibility degree, and predictions showed that there would be almost no alterations.



Landscape

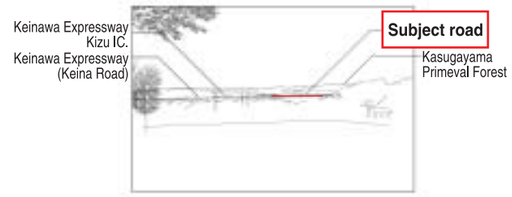
Mt. Wakakusa

Low visibility degree, and predictions showed that there would be almost no alterations.



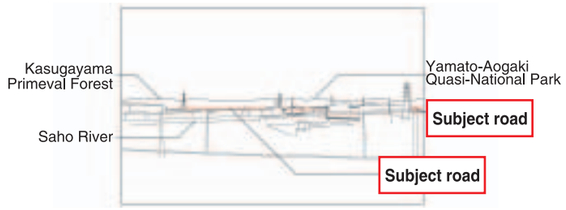
Onjogatani Park Kizu Town, Kyoto Prefecture

Low visibility degree, and predictions showed that there would be almost no alterations.



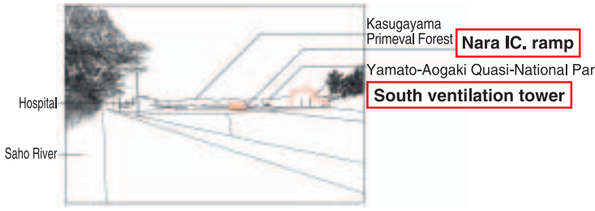
Yamatokoriyama City Kujo Park Sports Center

Low visibility degree, and predictions showed that there would be almost no alterations.



Saho River Waterfront Walkway, Nara City

The south ventilation tower and the Nara Interchange are within a close-range view from the walkway, and they interrupt the skyline of the mountains in the Yamato-Aogaki Quasi-National Park, an important scenic resource. As an environmental preservation measure, we will conduct studies on the design and coloration of the road structures and the ventilation towers, and conduct planting works near these facilities.



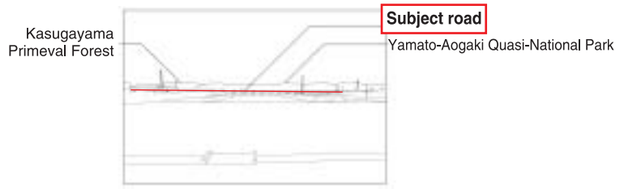
※ In regard to the shape of the ventilation towers, while proceeding with the design of the facilities once the actual construction works are initiated, we will conduct studies on the harmonization of facilities with the landscape in the vicinity, based on the regulations for land use in the area and the actual usage situation.

Landscape

Saho River Waterfront Walkway, Yamatokoriyama City

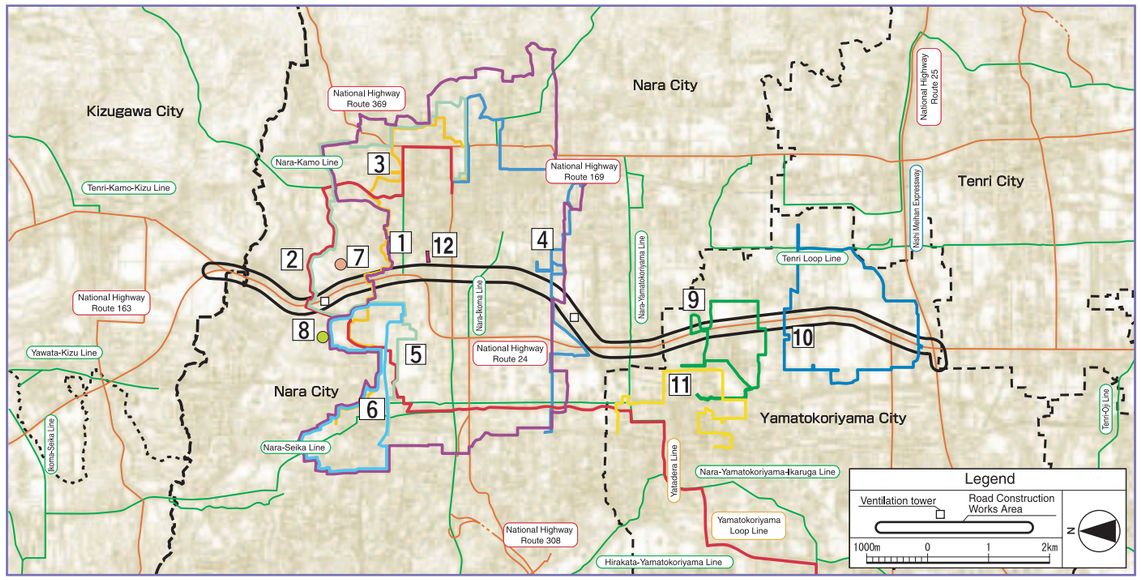
The subject road is within a close-range view from the walkway, and it could be quite obvious from a horizontal viewpoint.

As an environmental preservation measure, we will conduct studies on the design and coloration of the road structure, and conduct planting works near the facilities.



Locations for Contact with Nature

In regard to the locations for contact with nature, predictions were conducted at 12 locations on walking course stc. All of the locations were within 500 meters of the road construction works area.



No.	Symbol	Name	No.	Symbol	Name
1		Historical Roads	7		Kurogamiyama Campfield
2		Nara Bicycle Paths	8		Heijo Outdoor Training Center
3		Nara Historical and Cultural Greenery Links Course	9		Environment Data Map East district (North route)
4		Serene Cities and Rural Walking Course	10		Environment Data Map East district (South route)
5		North Nara Basin Border Ancient Shrines, Temples and tumuli Course	11		Environment Data Map North district (East route)
6		Akishino-no-Sato and Saki-ji Course	12		Saho River Mizube-no-gakko (Riverside Environment School)

While there will be some partial alterations conducted at locations where the Nara Bicycle Paths and the Historical Roads intersect with the subject road, the area where such changes will be made is very small. We have plans to make sure that the function of these roads, walkways and paths will be preserved. Predictions have shown that there will be almost no alterations due to the existence of the roadway, the performance of the road construction works, and the serviceability of these facilities due to the existence of the roadway.

In addition, predictions conducted at other points have shown that there will be no alterations due to the existence of the roadway, the performance of the road construction works, and the serviceability of these facilities due to the existence of the roadway.

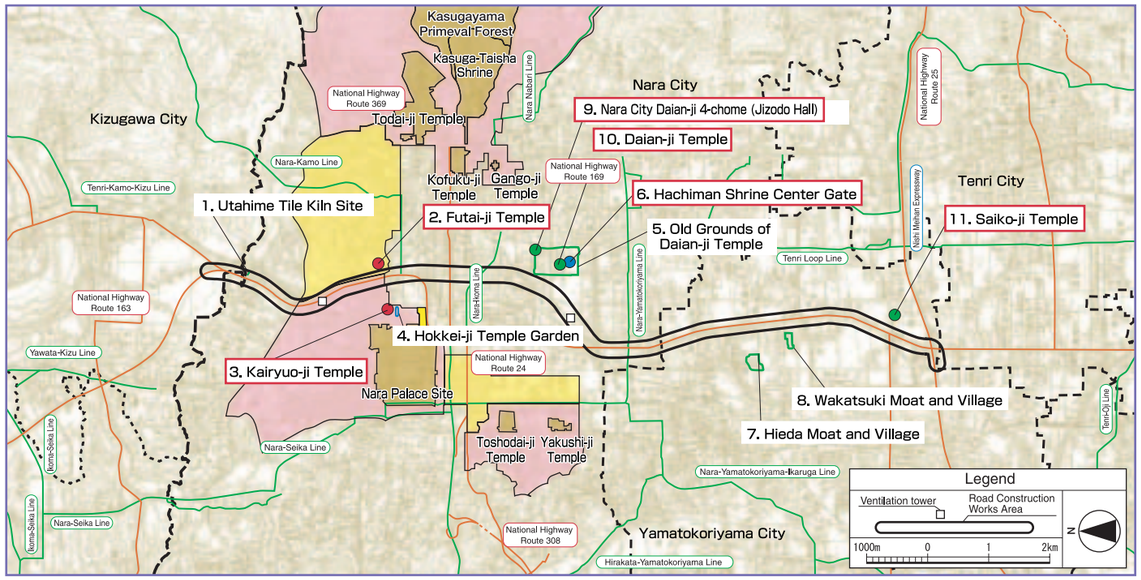
Historical Road

Nara Bicycle Path

Cultural Properties

Cultural Properties

Predictions on the impact on cultural properties were conducted at 11 points in an area 500 meters or less from the road construction works area. In addition, predictions on the impact on tangible cultural properties due to nitrogen dioxide and sulfur dioxide were conducted at 6 of these 11 prediction points, where there are such tangible cultural properties.



※ Prediction points for the impact on atmospheric quality and tangible cultural properties

- World Heritage Property
- Buffer Zone
- Harmony Zone
- Historic Site
- Place of Scenic Beauty
- Tangible cultural property (buildings and other structure, fine arts and crafts)
- Tangible cultural property (buildings and other structure)
- Tangible cultural property (fine arts and crafts)

1. Alterations to Cultural Properties

There will be no alterations to the cultural properties due to the existence of the road, or the construction yards and access roads, which will be constructed at locations away from the cultural properties.

2. Alterations to the Atmosphere of Cultural Properties

Among the 11 cultural properties selected as prediction points, the "Utahime Tile Kiln Site" is located approximately one meter away from the roadway as it transits the area as an elevated structure. In order to preserve the atmosphere of the cultural property, we will conduct studies on the shape, design and coloration of the road structure.

Utahime Tile kiln Site, which is the subject of preservation measures

3. The Impact of Nitrogen Dioxide and Sulfur Dioxide on Cultural Properties

In regard to the environmental impact on the tangible cultural properties due to nitrogen dioxide and sulfur dioxide, the results of predictions conducted at the closest tangible cultural property showed that the concentration of nitrogen dioxide and sulfur dioxide were 0.0003 ppm and 0.00002 ppm, respectively. The background concentrations (nitrogen dioxide 0.016 ppm, sulfur dioxide 0.004 ppm) were about 1.9% and 0.5%, respectively.

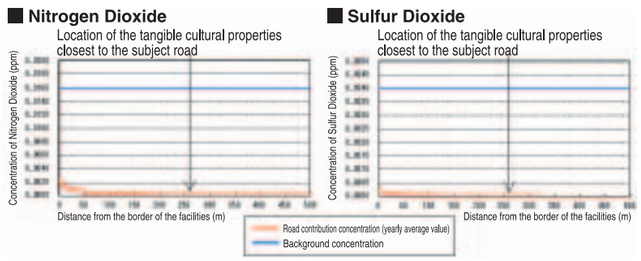
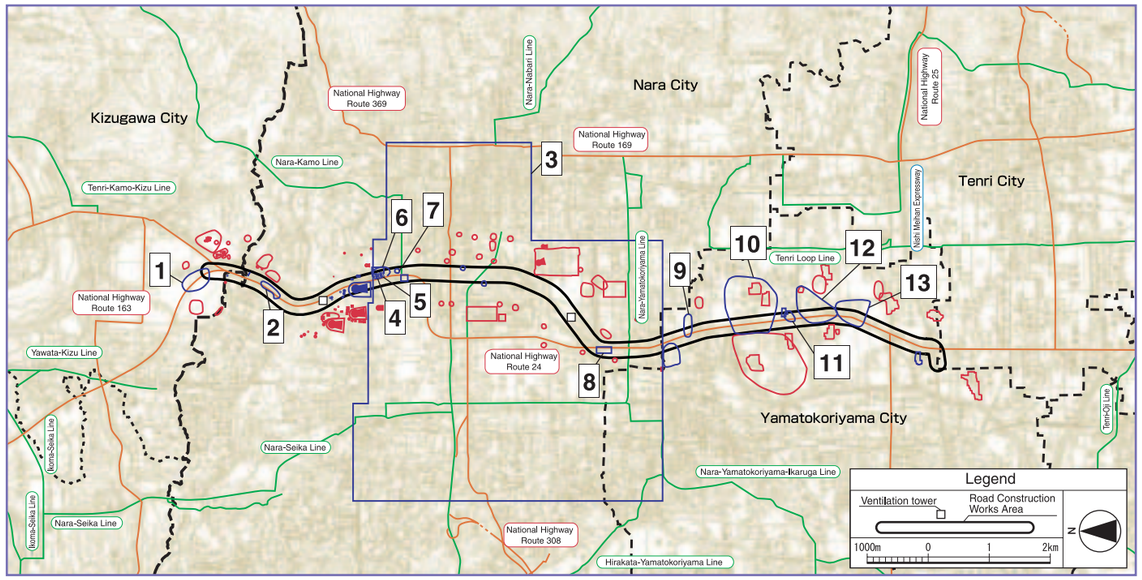


Figure: The general relationship between the distance from the facilities and the decrease in the concentration of nitrogen dioxide and sulfur dioxide

Buried Cultural Properties Known to Exist Underground

Predictions on the impact on the buried cultural properties known to exist underground were conducted at 33 locations within the road construction works area.



Legend

- Buried cultural properties exist underground
- Buried cultural properties exist underground, within the road construction area

※ No. 1-13 indicate areas the road goes through where it is known that buried cultural properties exist underground.

Among the 33 locations with buried cultural properties that exist within the road construction works area, there are 13 locations, including the Nara Capital Site, that will undergo alterations.

Locations with buried cultural properties that will be altered due to the road construction			
1	Yumita Site	8	Sogo-ji Temple
2	Hase Site	9	Takotakami Site
3	Nara Capital Site	10	Minosho Site
4	Hiratsuka Tumulus No. 1	11	Shingondo Site
5	Hiratsuka Tumulus No. 2	12	Hatsushiin Site
6	Unnamed site (land with scattered relics)	13	Harumichi Site
7	Unnamed site (holes in the earth)		

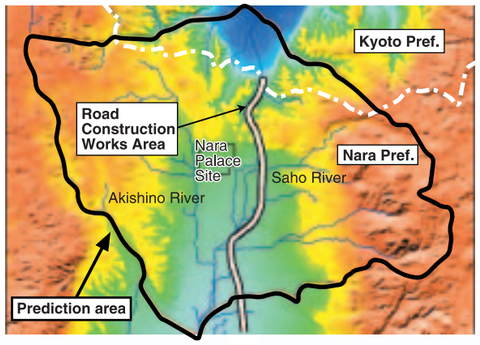
Environmental Preservation Measures

In preparation for the performance of the construction works, we will work in close cooperation with the related authorities and conduct excavation studies. Based on the results of these studies, and again with the cooperation of the related authorities, we will conduct measures to preserve the buried cultural properties known to exist underground, including those stipulated in the Law for Protection of Cultural Properties, such as the preservation of records of the finds, etc.

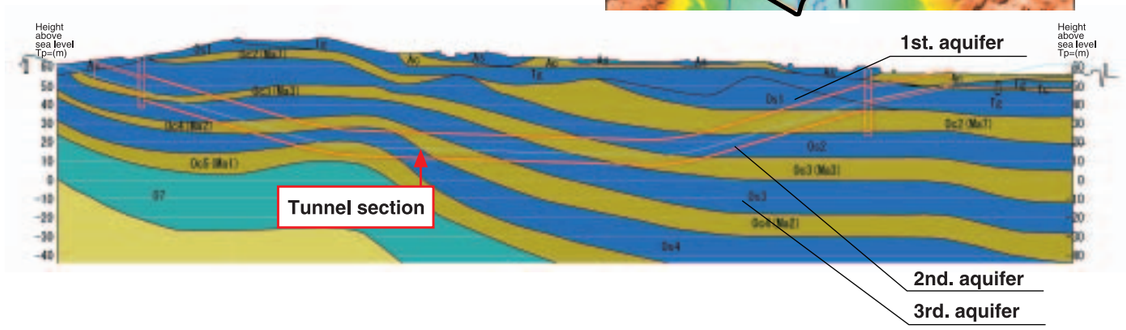
Cultural Properties

Groundwater

Predictions were conducted for the first aquifer of the groundwater, said to contain buried cultural properties such as *mokkan* (wooden tablets for writing).

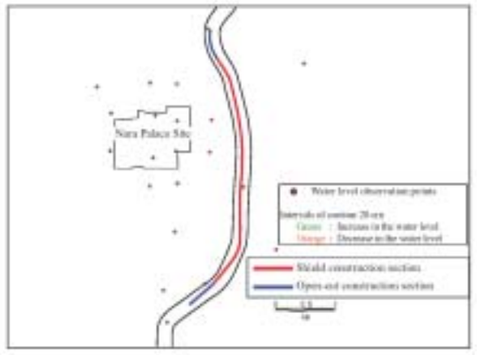


Cross section showing the ground properties where the road will go underground



The predictions showed that the fluctuation in the groundwater level of the 1st aquifer due to the construction of the subject road would be only a few centimeters, a value much smaller than the seasonal fluctuations (the average seasonal fluctuation for the period from 2000 through 2004 was approximately 81 cm).

The subject road will employ a shield tunnel structure, and in the open-cut sections, the Groundwater Flow Preservation Method will be employed as an environmental preservation measure, both during and after the construction works. In order to verify the effect of the use of the Groundwater Flow Preservation Method, the current monitoring of the groundwater level will be continued during and after the completion of the construction works, and furthermore, based on the results of the studies conducted by the Yamato-Kita Road Groundwater Monitoring Study Committee, pre-construction measures will be enacted, in consideration for any possible impact on the environment, such as the construction of a groundwater recharge pond, and recharge wells.

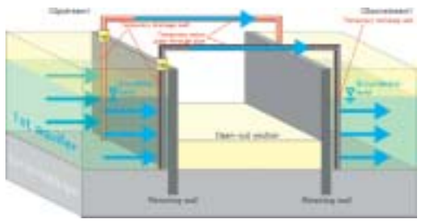


Technical Terms

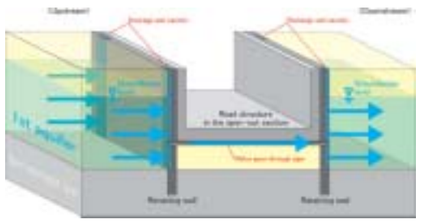
Groundwater Flow Preservation Method

In order to ensure maintenance of the present groundwater flow conditions, we will employ the groundwater flow preservation method, which allows the groundwater to flow during and after the construction of the structures and retaining walls.

During construction



After completion



Waste Material

The utmost effort will be employed to use the road construction works areas of the subject road for the reuse of earth generated by the construction works. In regard to the sludge generated by the tunnel construction works, the generation of sludge will be controlled and decreased as much as possible, and as much as possible, the sludge will be reused. The employment of the sludge recycling system will be considered in the actual construction stage.

Furthermore, in regard to the concrete and asphalt-concrete lumps, these waste materials will be recycled as much as possible and for the remaining volume that cannot be either reused or recycled will be processed and disposed of according to the related laws and regulations. We will do our best to reuse and recycle these construction by-products.

General Assessment

Studies, predictions and assessments on the following fourteen subjects were conducted for this environmental impact assessment.

1. Quality of air	6. Topographical and geological features	11. Landscape
2. Damage due to strong winds	7. Sunlight hindrance	12. Locations for contact with nature
3. Noise	8. Fauna	13. Cultural properties
4. Vibration	9. Flora	14. Waste material
5. Low-frequency noise	10. Ecosystem	

- In regard to the "topographical and geological features" and "sunlight hindrance," we consider that there will be no conspicuous environmental impact related to the road construction works.
- Appropriate environmental preservation measures will be performed for "quality of air," "damage due to strong winds," "noise," "vibration," "low-frequency sound," "fauna, flora, and the ecosystem" "landscape (the existence of the road (elevated type) and the ventilation towers)," "locations for contact with nature," "cultural properties," and "waste materials."

It was judged that the organization that will conduct the road construction works has the capability, within a feasible range, to either avoid or mitigate any environmental impact.

- During the actual construction stage, detailed studies will be performed, and sufficient consideration will be paid to the results of the environmental impact assessment. Furthermore, based on the results of technological developments, studies will be performed to ensure, within a feasible range, that the best possible environmental preservation measures will be available for use if they are required.
- During the actual construction stage and after the completion of the construction works, in cooperation with the related authorities, we will grasp the environmental conditions and the traffic volume, etc., as required. Furthermore, in the case where an unexpected environmental impact occurs during the actual construction stage or new environmental criteria are announced, while receiving the advice and guidance of experts, as required, we will reassess the situation in the vicinity of the road, and perform appropriate measures for environmental preservation.
- We will also do our best to provide the citizens, etc., with sufficient explanations prior to the initiation of the construction works and make accurate information on the works available.