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# **Technical Services**



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### **Providing Technology and Solutions for Emerging Issues**

HAYASHI TELEMPU celebrated its 110th anniversary this year as a comprehensive manufacturer of automotive interior parts. As an independent supplier, we have transactions with all major domestic automobile manufacturers and have accumulated evaluation technologies over many years. Through our subsidiary Tokai Labo Ltd., established with a view to providing evaluation technologies at a yet higher level of specialization and expediency, we provide the following services.

### **1.** Physical property testing services for automotive interior and exterior parts

- 2. CAE analysis services for automobile interior and exterior parts
- **3. AAS\* technical services**

\* AAS = Advanced Acoustic Simulator.

Our Advanced Acoustic Simulator is a device using 3D sound technology capable of realistically recording and reproducing automotive motion sounds (direction, distance, spread), and using computer technology can reproduce the analysis



# **Physical Property Testing Services**

### **Overview**

HAYASHI TELEMPU has a long track record in physical property testing for the automobile industry. The Company has acquired the international standard ISO 17025 for testing and calibration laboratories. Testing capabilities and quality are approved by the Japan Accreditation Board.

### Service content (Please inquire for prices.)

ltem	Content	
Flammability test	<ul> <li>Combustibility test of automotive interior materials</li> <li>(products)</li> </ul>	
Odor test	•Evaluation of unpleasant odors emitted from automobile interior materials (products)	
Glass haze test (Fogging)	•Haze measurement of glass by volatile substances	
VOC analysis	<ul> <li>Qualitative and quantitative analysis of VOCs volatilizing from products</li> </ul>	
SOC analysis	•Qualitative and quantitative analysis of substances of concern (SOC) contained in products	
Normal incidence sound absorption test	•Measurement of sound absorption performance when sound perpendicularly st impinges on the sample	
Reverberation chamber method sound absorption test	<ul> <li>Measurement of sound absorption performance when sound impinges on the sample from random directions</li> </ul>	
Random incidence transmission loss test	<ul> <li>Measurement of sound insulation performance when sound impinges on the sample from random directions</li> </ul>	

# **CAE Analysis Services**

## Overview

HAYASHI TELEMPU has almost 20 years of CAE experience in the automotive industry. Backed by our technical capabilities and based on the experience we have fostered to date, we are able to offer problem solving proposals such as design quality improvement, solutions tailored to customer requests, and measures to resolve mass production defects.

### Service content (Please inquire for prices.)

Item	Software	Content		
Rigidity	Abaqus Marc	Analysis item: Prediction of deformation for various load conditions Target: Automotive interior and exterior parts, etc.		
Collision	LS-DYNA	Analysis item: Prediction of single-item collision performance Target: Door trim		
Injection molding Moldflow		Analysis item: Resin flow in the injection mold Target: Injection molded parts for automobile interior and exterior parts		

(Modeling) CAD: CATIA V5 Mesh: HyperMesh, ANSA Post: HyperView, etc.

Additionally, we own technologies for the following services. Please inquire.

- •Thermal fluid analysis (automotive electrical parts)
- •Acoustic analysis (soundproofing materials)

•Technology based on machine learning using past experiments and CAE results to predict the behavior of materials

# **AAS Technical Services**

# **Overview**

The AAS technology was developed independently by HAYASHI TELEMPU in 2018. AAS refers to a vehicle sound simulator capable of realistically reproducing the sound of the vehicle interior in motion. Using AAS enables conducting virtual test-drive events and reviewing targets for the vehicle under development.



### Service content (Please inquire for prices.)

ltem	Content	
Measuring and listening	<ul> <li>Measuring of vehicle sound in motion on customers' test course, etc., with listening on AAS</li> <li>Processing of sound data in motion for soundproofing materials examination with listening on AAS</li> </ul>	
Body (AAS) sales and rental	<ul> <li>Sales of AAS main units</li> <li>Rental of AAS main units for certain</li> <li>periods</li> </ul>	
Provision of vehicle data in motion	•Large number of vehicle sounds in motion recorded on AAS libraries for listening	





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# **Physical Property Testing Services**



# Flammability Test (FMVSS No.302)

### **Overview**

• Flammability test of automotive interior materials (manufactured products) Flammability tests are specified in US regulations (FMVSS No. 302) and automobile manufacturers' standards, and measure products' combustion speeds.

## **Features**

### **Test method**

• Horizontal flammability test

An indirect flame is applied for 15 seconds with sample material of specified size positioned horizontally to the flame. Subsequently, the speed at which the flame spreads is observed and measured, and the combustion speed is calculated.

### **Target product**

- Carpets and fabrics and other textile products used in car interiors as well as resin

products, synthetic leather products, etc.



Flammability tester



# **Odor Test**

# **Overview**

• Evaluation of unpleasant odors emitted from automotive interior materials (products) An olfactory sample is taken of the product and evaluated according to the method specified by automobile manufacturer's standards.

### **Features**

### **Test method**

Sensory test method

A sealed container holding the sample is heated, etc., and the odor is directly sampled and evaluated. In-house certified panelists judge the strength of the odor and the degree of comfort or discomfort.

### **Target product**

• Carpets and fabrics and other textile products used in car interiors as well as resin

products and synthetic leather products, etc.

### Utensils

Test bags for dry and wet conditions

Water extraction bags





# **Glass Haze Test**

## **Overview**

• Measurement of glass haze caused by volatile substances

This test reproduces and evaluates the conditions where substances volatilized from automotive interior materials (products) adhere to the window glass inside the car causing white overclouding (fogging) impeding visibility.

### Features

### Test method

• Air heating method

A sample of specified size is placed into a glass container with a transparent glass substrate placed on top. Subsequently, at the specified temperature and after a specified period of time, substances volatilized from the sample adhere to the glass substrate. Using measuring instruments, the haze of the glass substrate before and after the test is determined (haze value = degree of cloudiness).

### Target product

• Carpets and fabrics and other textile products used in car interiors as well as resin

products and synthetic leather products, etc.

## Equipment

Fogging tester



Haze meter



# **VOC Analysis**

# Overview

•Qualitative and quantitative analysis of VOCs volatilizing from products VOC is an abbreviation for volatile organic compounds. It is a general term for organic compounds that easily volatilize into the air at normal temperature and atmospheric pressure. VOCs are contained as solvents in adhesives and paints, etc. Solvents are collected from target products and analyzed using VOC analysis.

### Features

### **Analysis method**

• Sampling bag method (Bag sizes: 10L, 20L, 300L)

A sample is placed into a sampling bag, which is then sealed and nitrogen gas is added. The bag is heated to a specified temperature for a specified period of time to collect volatile components, which are measured using an analyzer.

### **Target components**

• Thermal desorption gas chromatography (TD-GC, MS) analysis: 9 components

Benzene, toluene, xylene, ethylbenzene, styrene, paradichlorobenzene, tetradecane,

di-n-butyl phthalate, di-2-ethylhexyl phthalate

High performance liquid chromatograph (HPLC) analysis: 3 components

Formaldehyde, acetaldehyde, acrolein

# Equipment

Thermal desorption-gas chromatograph-mass spectrometer



High performance liquid chromatograph [HPLC]



# **SOC Analysis** (Compliant with RoHS, ELV directives)

## **Overview**

- Qualitative and quantitative analysis of substances of concern (SOC) contained in products
- Measurement of hazardous substances restricted by
- RoHS Directive (restrictions on the use of hazardous substances in electrical and electronic equipment)
- ELV Directive (End-of-Life Vehicle Directive)

### **Features**

### **Analysis method**

• Screening analysis using an energy dispersive X-ray fluorescence spectrometer The sample is irradiated with X-rays and the energy of the excited characteristic X-rays and fluorescent X-rays is measured. The element of the sample is analyzed from the obtained spectrum.

### Target substances

• Cadmium (Cd), lead (Pb), mercury (Hg), total chromium\*1 (Cr), total bromine\*2 (Br)

Detectable element range:  $11Na \sim 92U$ 

\*1: Cr6+ identification includes all other forms of Cr

\*2: Since PBB, PBDE contains bromine (Br) in its structure, all forms of Br are targeted

## Equipment

Energy dispersive X-ray fluorescence analyzer



# **Normal Incident Sound Absorption Test**

### Overview

- Testing of sound-absorbing properties of sound-absorbing materials such as fibers and foams
- Tests use the transfer function method and indicate the sound absorption coefficient when sound impinges perpendicularly on the sample.

### Features

### **Analysis method**

• The sample is set into an acoustic tube. The sound absorption coefficient is calculated from the relationship between the incident sound and the reflected sound.

### Target frequency and sample size



# 音背試吸反入入

- •50~1600Hz φ100mm
- •1600~6400Hz φ29mm
- •6400~12800Hz φ15mm

# Equipment

Vertical incidence sound absorption coefficient measurement system JISA1405-2



### Sound Absorption Coefficient Test (Reverberation Room Method)

### **Overview**

- Tested are the sound-absorbing properties of sound-absorbing materials such as fibers and foams.
- This test uses the reverberation chamber method and indicates the sound absorption coefficient when sound impinges on the sample from random directions.
- Hayashi Telempu has two types of measurement systems.

## Features

### **Analysis method**

- Reverberation time T1 is measured with no sample present in the chamber. Reverberation time T2 is subsequently measured with the sample set on the floor of the chamber.
- Sound absorption performance is calculated using the following

formula:

$$\alpha = \frac{55.3V}{cS} \left(\frac{1}{T_{\star}} - \frac{1}{T_{\star}}\right)$$



音*0* マイ 試料

#### 

 $\alpha$ :吸音率、V:部屋の容積(m3)、c:音速(m/s)、S:試料表面積(m2)、 $T_1$ :試料なし時の残響時間(sec)、 $T_2$ :試料あり時の残響時間(sec)

吸音率 sound absorption coefficient 音速 speed of sound 試料なし時の残音時間 reverberation time without sample 試料あり時の残音時間 reverberation time with sample 部屋の容積 volume of sound chamber 試料表面積 sample surface area

### **Target frequency and sample size**

- Large reverberation chamber 200 6300Hz 1800mm×1800mm
- •Alpha-Cabin 400 10000Hz 1200mm×1000mm

## Equipment

Large reverberation chamber

Alpha-Cabin





# **Random Incidence Transmission Loss Test**

### Overview

- Tested are the characteristics of sound insulation for structures such as single and double walls.
- This test shows the sound insulation performance when sound impinges on the sample from random directions.
- HAYASHI TELEMPU has two types of measurement systems.

### Features

### **Analysis method**

• The sample is set on the dividing wall between two chambers and sound is released from a speaker. Measured are the sound pressure level L1 in the chamber of the sound source and the sound pressure level L2 in the sound receiving chamber. The transmission loss is calculated using the following formula.



音 sound マイク microphon 試料 sample スピーカー speak

$$TL = L_1 - L_2 + 10 \log_{10} \frac{S}{A}$$

 $TL: 透過損失、 <math>L_1: 音源室の音圧レベル (dB)、 L_2: 受音室の音圧レベル (dB)、S: 試料面積 (m<sub>2</sub>)、 A: 受音室内の吸音力 (m<sup>2</sup>)$ 

### Target frequency and sample size

• Reverberation chamber - anechoic chamber 200 - 6300Hz 600mm×600mm

●Isokell 125 - 5000Hz 1200mm×1000mm

## Equipment

Reverberation chamber, anechoic chamber

ISO15186-1 compliant







透過損失 transmission loss

受音室の音圧レベル sound pressure level in sound receiving chamber

受音室内の吸音力 sound absorption in sound receiving chan 音源室の音圧レベルsound pressure level in sound source cha 試料面積 sample surface area



### Contact for inquiries

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# **CAE Analysis Services**



# **Stiffness Analysis**

## **Overview**

- This analysis serves to predict the deformation of automotive interior and exterior parts under various load requirements.
- Deformed shape
- Stress and strain distribution
- Load-deformation graph



# Features

### **High analysis accuracy**

- Predictions derived from high-accuracy analysis based on expertise acquired through large numbers of CAE instances and actual equipment verifications
- Analysis results: Luggage space board load deformation, door-trim hand bending rigidity, etc.
- Target materials: PP, ABS, foamed PP, bead foam, wood board, etc.
- -Material data: Selected according to the analysis target, such as tension, compression, and bending tests

### **Precise improvement proposals**

- Appropriate improvement proposals based on expertise obtained through large numbers of CAE instances and actual equipment verifications
- Improvement proposals in accordance with shape, structure, and reinforcing materials
- Proposals for appropriate materials

## Equipment

Selection from the following two software applications depending on the analysis target

- Software: Abaqus, Marc
- Hardware: Workstation



# **Crash Analysis**

## **Overview**

- Predictions of single door trim collision performance
- Load-displacement characteristics
- Stress / strain distribution
- Absorbed energy (EA) amount





## **Features**

### High analysis accuracy

• Predictions derived from high-accuracy analysis based on expertise acquired through

large numbers of CAE instances and actual equipment verifications

- Analysis results: In-house manufactured door trim collision analysis (solid, foam resin)

- Target materials: PP, foamed PP, bead foam, rigid urethane, etc.
- Material data: Identified by low, high speed tensile and manufactured products tests

### Speedy improvement proposal

• Speedy verification of improvement effects through modeling optimizing both accuracy and calculation time

- Determination of optimal mesh size and boundary conditions
- Wide range of improvement proposals such as for parts structure and selection of appropriate materials, etc.

# Equipment

Software with proven track record provides highly accurate results

- Software: LS-DYNA
- Hardware: HPC cluster system



# **Injection Molding Analysis**

## **Overview**

- Prediction of resin flow in the injection mold
- Required clamping force / injection pressure
- In-mold pressure distribution
- Weld position

[Door trim example]



# Features

### Fast modeling, fast calculation

• Numerous studies are possible through modeling (neutral plane) optimizing both accuracy and calculation time.

- Modeling: Semi-automated neutral-plane creation (own development) enables fast and faithful creation of the original

- Calculation speed: High-speed calculation due to neutral plane enabling a diversity of considerations

### Accurate improvement proposals

- Appropriate improvement proposals based on expertise acquired through large numbers of CAE instances and actual equipment verifications
- Optimal gate position and multi-point gate opening, closing timing with consideration of productivity
- Proposals for appropriate materials

# Equipment

Providing high-precision results using software with a rich track record and ample materials libraries

- Software: Moldflow
- Hardware: Workstation





### Contact for inquiries

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**Advanced Acoustic Simulator** 



# Overview

The AAS developed independently by HAYASHI TELEMPU in 2018 is a vehicle sound simulator capable of realistically reproducing a vehicle's interior sound in motion.



### Feature (1) Precise reproduction of vehicle interior sound

Precise reproduction of the vehicle interior sound in motion using
 3D sound technology

### Feature (2) Simultaneous playback of sound, visual, and vibration

- Simultaneous playback of visual and vibration recorded simultaneously
- with sound provides a highly realistic reproduction of the driving scene.

# Feature (3) Playback of the actual sound with sound proofing materials changed

- Analysis and prediction of sound alteration after change of sound proofing materials, with result rendered audible on sound system.

- Soundproofing materials can be changed with regard to positioning, material, and thickness, etc.



# **AAS Technical Services**



# **AAS Technical Services**

Providing three technical services using AAS

# Measuring and listening

 Measuring the vehicle sound in motion on the customer's test course, etc., and listening to the sound on AAS

- AAS enables virtual test drive events
- Processing of sound data of vehicle in motion for soundproofing materials examination and listening on AAS
- Equalizing available for 54 separate directions
- Analysis and prediction of sound alteration after change of sound proofing materials,

with result rendered audible on sound system.

- AAS properties enable target allocation to each individual part

### AAS main body sales and rental

- Sales of AAS main units
- Equipment rental for specified periods of time

# Provision of driving data

- Listening to a diversity of vehicle sounds in motion recorded on the AAS library
- Recording location: Hayashi Terempu test course with 5 types of road surfaces
- Recording conditions; 60, 80, 100kmh front seat, rear seat (3 seats)
- Usage fee options available such as pay-as-you-go system and flat-rate system for all data
- Data can be used overseas via cloud access
- Actual floor carpets used for recorded vehicle sounds in motion can be viewed at HAYASHI TELEMPU.

# **Technical Service Details**

Item		Service mode	
	Driving data measurement	Pay-as-you-go	
Measuring and listening service	Equalizing		
	CAE rendering		
Main body (AAS) sale and rental		Measurement equipment is not covered. Options; Equalizing function	
Motion data provision service		Usage method	Use of AAS
		Regular	Pay-as-you-go
		Virtual test drive package (Up to 5 car models)	Half day , full day rental
		Unlimited listening (Unlimited car models)	Half day , full day rental
			Yearly

#### • Important usage information

 $\Diamond$ Reproduction, redistribution, and modification of recorded data is prohibited.  $\Diamond$ Services available for manufactured products are subject to change, suspension, or termination without notice.  $\Diamond$  Leakage of confidential information about the AAS system to a third party is prohibited.  $\Diamond$  Regarding the optional driving data listening service, any period for resolving data incompleteness is not included in the service usage period.



# Usage examples

# **Example 1 - Virtual test-ride events**

• Without visiting the actual site, AAS renders sensory evaluations possible for locations such as customers' test courses in Japan and overseas.

### Advantages

- (1) Enhanced efficiency surrounding test-ride events
- Fewer man-hours required for moving from place to place
- Independence from weather conditions
- (2) Enhanced sensory evaluation accuracy
- Listening and comparing without gap time in between
- Simultaneous listening to the same motion sound by all persons involved
- (3) Listening by small groups spread over several sessions
- Effective in situations when no large group can assemble

# **Example 2 – Target setting**

• Numerical studies previously conducted can be reviewed by listening using AAS.

### Advantages

- (1) Efficient determination of vehicle target values
- Enables actually listening to set vehicle target sounds and determine target values as envisioned
- (2) Parts target allocation
- -In combination with CAE, enables listening to the sound of changed
- soundproofing materials as well as usage for parts target allocation.



### Contact for inquiries

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