



INSTITUTO CENTRAL DE GESTIÓN DE LA INVESTIGACIÓN

**"Año del Bicentenario, de la consolidación de nuestra Independencia,  
y de la conmemoración de las heroicas batallas de Junín y Ayacucho"**

Lima, 26 de marzo del 2024

Oficio N° 093-2024-OPI-ICGINV-VRIN-UNFV.

Econ.

**JOSÉ CONDORI QUÍSPE**

Jefe de la Dirección General de Administración

Presente. –

Asunto: SERVICIO DE PUBLICACIÓN EN REVISTA INDIZADA  
Docente: Doris Esenarro Vargas

Referencia: OFICIO N° 1063–2024–UCSB–OASG–UNFV  
PROVEIDO N° 3330-2024-DIGA-UNFV

Tenemos a bien dirigirnos a usted con la finalidad de saludarlo cordialmente, asimismo en base a los documentos de la referencia, se devuelve el presente expediente con el formato SIGA, con la finalidad que se sirva autorizar y continuar el trámite de pago en revista indizada, para la publicación del artículo "Transportation system and the improvement of urban vehicular 3 flow in the district of Huánuco-Perú 2022".

Sin otro particular, aprovecho la ocasión para expresarle las muestras de mi consideración.

Atentamente.



Firmado digitalmente por:  
MONROY CORREA GRACIELA MARTINA  
FIR 09715476 hard  
Motivo: Soy el autor del documento  
Fecha: 26/03/2024 15:24:37-0500

**Dra. Graciela Martina Monroy Correa**  
Jefa de Oficina de Proyectos de Investigación

**Dr. José Héctor Livia Segovia**  
Firmado digitalmente por:  
DIRECTOR DEL INSTITUTO CENTRAL  
FIR 07288224 hard  
Motivo: Soy el autor del  
documento  
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Adj.: 55 folios  
NT: 015824- 2024

PEDIDO DE SERVICIO Nº

000225

UNIDAD EJECUTORA : 001 UNIVERSIDAD NACIONAL FEDERICO VILLARREAL  
NRO. IDENTIFICACIÓN : 000102

Tipo Uso : Consumo

Dirección Solicitante : INSTITUTO CENTRAL DE GESTIÓN DE LA INVESTIGACION- VRIN  
Entregar a Sr(a) : LIVIA SEGOVIA JOSE HECTOR  
Fecha : 26/03/2024  
Actividad Operativa : C0523 SUBVENCIÓN DE PAGO POR CARGO DE PROCESAMIENTO DE ARTÍCULOS EN REVISTAS DE  
Motivo : PUBLICACIONES DE ARTÍCULOS CIENTÍFICOS EN REVISTA INTERNACIONAL, DRA. DORIS ESENARRO VARGAS

FF/Rb	META / MNEMONICO	Función	División Func.	Grupo Func.	Programa	Prod/Pry	Act/Ai/Obr
1-00	0024	22	048	0015	9002	3999999	5001792

Código	Descripción / Términos de Referencia	Clasificador	Valor S/.	Unidad Medida
150100020007	PUBLICACIONES DE ARTÍCULOS CIENTÍFICOS EN REVISTA INTERNACIONAL	2.3. 2 2. 4 1	11,400.00	SERVICIO



Firma del Solicitante



Firma Autorizada



## ANEXO 1

### SOLICITUD DE FINANCIAMIENTO PARA PUBLICACIÓN (DOCENTES)

Lima de 16 Febrero del 202

Señor Vicerrector (a) de la Universidad Nacional Federico Villarreal  
Pedro Amaya Pingo

Yo, ESENARRO VARGAS, DORIS, docente adscrito a la Facultad de Ingeniería Geográfica, Ambiental y Ecoturismo. Ordinario, en la Categoría: Auxiliar a TP.

Con domicilio en Av. Juan Pezet 1505 Dpto. 702, distrito de San Isidro,

Identificado con código N° 2015038 , DNI N°09471808, e-mail [desenarro@unfv.edu.pe](mailto:desenarro@unfv.edu.pe), en

calidad de coautor del artículo **“TRANSPORTATION SYSTEM AND THE IMPROVEMENT OF URBAN VEHICULAR FLOW IN THE DISTRICT OF HUANUCO-PERU 2022”**

Solicito financiamiento para su publicación en la revista infrastructures,  
Teniendo como coautores:

Yessica Julia Verastegui Ayala (Coautor)

Doris Esenarro Vargas (coautor)

Para lo cual se adjunta:

- Artículo en PDF
- Certificado de aceptación de publicación
- Factura de costo de publicación de la revista.

Atentamente,

Doris Esenarro Vargas  
Docente responsable



## **FORMATO N° 01**

### **TÉRMINOS DE REFERENCIA PARA SERVICIOS**

#### **1. ÁREA USUARIA**

Instituto Central de Gestión de la Investigación

#### **2. DENOMINACIÓN DE LA CONTRATACIÓN**

Servicio de publicación de artículo científico en revista indizada internacional

#### **3. FINALIDAD PÚBLICA**

El Instituto Central de Gestión de la Investigación tiene como parte de sus funciones, promover la investigación, producción científica, innovación y emprendimiento de los docentes y estudiantes de la Universidad Nacional Federico Villarreal, estableciendo estrategias que coadyuven a cumplir con las metas propuestas.

Debiendo contar para ello con la evidencia necesaria de las múltiples investigaciones que realizan los docentes y estudiantes de la comunidad villarrealina, a través de la publicación de los artículos en revistas indexadas de alto impacto a nivel internacional.

#### **4. ANTECEDENTES**

En el marco de las estrategias establecidas nuestra casa de estudios ha a través de sus recursos directamente recaudados otorgara financiamiento por servicio de publicación de artículos científicos en revistas especializadas e indexadas a nivel internacional. R. N° 236-2022-UNFV San Miguel, 28 abril de 2022. Directiva LINEAMIENTOS Y PROCEDIMIENTOS PARA EL ACCESO AL FINANCIAMIENTO DEL SERVICIO DE LAS PUBLICACIONES EN REVISTAS INDIZADAS, (web of science, scopus, scielo).

#### **5. OBJETIVO DE LA CONTRATACIÓN**

Financiar el servicio de publicación de artículos científicos en una revista indexada a nivel Internacional.

#### **6. REQUERIMIENTO, CARACTERÍSTICAS Y CONDICIONES**

##### **6.1. REQUERIMIENTO**

<b>N° Ítem</b>	<b>Código Siga</b>	<b>Descripción del servicio</b>	<b>Unidad de Medida</b>	<b>Cantidad</b>
01	000225	Publicación de Artículo en Revista Científica	Servicio	01

##### **6.2. CARACTERÍSTICAS DE LA REVISTA**

Deberá ser una revista científica de investigación a nivel internacional.

Deberá tener publicaciones semi-mensual y acceso libre e inmediato a su contenido a través de las páginas web.

La revista deberá figurar en las bases de datos especializadas en revistas científicas indexadas, como: scopus, web of science, scielo.

##### **6.3. RESPONSABILIDAD DEL CONTRATISTA**

###### **6.3.1. Plazo de reposición**

En caso de detectarse errores ortográficos y/o gramaticales, luego de la publicación del artículo en la revista indizada, el área usuaria dentro de los dos (02) días hábiles siguientes de realizada la publicación, solicitará a través de la Oficina de Abastecimiento y Servicios Generales, se notifique al proveedor el sentido de las observaciones y el plazo para su reposición (nueva publicación).

### 6.3.2. Garantía comercial

El proveedor otorgará una garantía comercial para avalar que el servicio prestado cumple con todas las características y condiciones establecidas en los términos de referencia, el cual no podrá ser menor a un (01) año, computados a partir de la entrega de la Constancia del artículo publicado.

Para lo cual una vez identificado el servicio que presenta defectos, se notificará al proveedor para su reposición inmediata en un plazo máximo de tres (03) días calendario computados luego de la notificación de la carta por parte de la Oficina de Abastecimiento.

### 6.3.3. Responsabilidad por vicios ocultos

El plazo máximo de responsabilidad del contratista es de un (01) año, contado a partir de la conformidad otorgada por la Entidad.

## 6.4. LUGAR DONDE SE EJECUTARÁ LA PRESTACIÓN

No aplica

## 6.5. CONDICIONES DE LA PRESTACIÓN

La publicación se realizará a través de una plataforma especializada de forma virtual, de acuerdo a las condiciones establecidas por el proveedor.

## 6.6. PLAZO DE EJECUCIÓN DE LA PRESTACIÓN

Entregable	Plazo
Constancia del artículo publicado	Hasta cien (100) días calendario siguientes, computados a partir del día siguiente de recibido el pago correspondiente.

## 6.7. FORMA DE PAGO

La Entidad debe pagar las contraprestaciones pactadas a favor del contratista de forma previa en pago único, a la publicación de artículo por derecho a la revista indexada, siempre que se verifiquen las condiciones establecidas en los términos de referencia y previa presentación del Formato N° 04 - Autorización para realizar el pago previo a la publicación por derecho a la revista indexada, por parte del área usuaria

## 6.8. CONFORMIDAD

La conformidad de la prestación será dada expresamente por el Director del Instituto Central de Gestión de la Investigación - ICGI de la UNFV, dentro de los dos (02) días hábiles siguientes de la verificación y cumplimiento de la prestación de acuerdo al requerimiento y la orden de servicio.

## 6.9. PENALIDADES

No aplica.

## 6.10. CONFIDENCIALIDAD

El proveedor deberá guardar absoluta confidencialidad en el manejo de la información y documentación a la que tenga acceso durante la prestación del servicio, no podrá revelar detalles sobre el alcance del servicio a terceros, excepto cuando resulte estrictamente necesario para el cumplimiento de la prestación. En ambos casos el proveedor deberá dar cumplimiento y será responsable de la aplicación a todas las políticas definidas por UNFV en materia de seguridad de la información.

## 6.11. VICIOS OCULTOS

El plazo máximo de responsabilidad del contratista es de un (01) año, contado a partir de la conformidad otorgada por la Entidad.



## 6.12. NORMATIVA ESPECÍFICA



No aplica

## 6.13. ANEXOS U OTROS DOCUMENTOS EN RELACIÓN CON LA CONTRATACIÓN.



- Carta de aceptación remitida por el proveedor.
- invoice remitida por el proveedor.
- Formato de Validación de los Términos de Referencia.
- Formato de Conversión de moneda y Cálculo de obligaciones tributarias.
- Formato de Autorización para realizar el pago previo a la publicación por derecho a la revista indexada, de ser caso.
- Ficha técnica de la revista.  
El artículo a publicar en formato digital.



FORMATO Nº 2					
VALIDACIÓN DE LOS TÉRMINOS DE REFERENCIA					
Revisión y/o verificación del cumplimiento de los Términos de Referencia					
1	DENOMINACIÓN DE LA CONTRATACIÓN			"Publicación de artículo en revista científica"	
2	DEPENDENCIA USUARIA			INSTITUTO CENTRAL DE GESTION DE LA INVESTIGACION	
ÍTEM Nº	DESCRIPCIÓN DEL ÍTEM			PROVEEDOR	
	Descripción clara y precisa del objeto de la contratación	Cantidad	Cumple	Razón Social	MDPI
	Pertenecer a una sociedad internacional con reconocida trayectoria en niveles K-12.A12	1	SI	RUC	PROVEEDOR DEL EXTRANJERO
	La editorial dueña de la revista debe tener varias publicaciones especializadas en enseñanza multicultural.	1	SI	Número de Cotización / Invoice / Factura / Orden	2833030
	La revista debe figurar en las bases de datos especializadas en revistas científicas indexadas como: Scopus.		SI / NO	Fecha del documento remitido	27/02/2024
				Otros (pais proveedor)	SUIZA
3	NOTAS / OBSERVACIONES		SE REQUIERE EL PAGO PREVIO		
4	FECHA DE ELABORACIÓN DEL DOCUMENTO:		13/03/2024		
5	<div>EMITIDO Y APROBADO POR:</div> <div><div>Dr. Jose Hector Livia Segovia Director del Instituto Central de Gestion de Investigacion</div><div></div><div><div> Dra. Graciela Monroy Correa Jefa de la Oficina de Investigacion de Proyectos</div></div></div>				

FORMATO Nº 3					
CONVERSIÓN DE MONEDA Y CÁLCULO DE OBLIGACIONES TRIBUTARIAS					
1	DENOMINACIÓN DE LA CONTRATACIÓN	"Publicación de artículo en revista científica"			
2	DEPENDENCIA USUARIA	INSTITUTO CENTRAL DE GESTION DE LA INVESTIGACION			
3	DATOS DEL PROVEEDOR				
	Razón Social	MDPI			
	RUC	PROVEEDOR DEL EXTRANJERO			
	Número de Cotización / Invoice / Factura / Orden	2833030			
	Fecha del documento remitido	27/02/2024			
	Moneda y monto del importe	Moneda del importe:	USD	Monto del importe:	2,042.16
3	CALCULO DE PAGO				
	Moneda y monto del importe	USD 2,042.16			
	Tipo de cambio SBS al día 12/03/2024	S/ 3.695			
	Moneda y monto del importe según conversión	S/ 7,575.78			
	Calculo de pago IGV no domiciliado (18%)	S/ 1,358.24			
	Periodo en que se realiza el calculo de pago IGV no domiciliado	Mar-24			
	Retenciones (30%) según sea el caso	S/ 2,272.73			
	Gastos operativos / Comisiones	S/ 193.25			
	IMPORTE TOTAL PARA CERTIFICAR	S/ 11,400.00			
3	NOTA:	Para la contratación de servicios con proveedores no domiciliados en el país, se aplicarán las normas tributarias y tratados internacionales correspondientes y vigentes a la fecha de elaboración de presente documento.			
4	FECHA DE ELABORACIÓN DEL DOCUMENTO:	13/03/2024			
5	 Dr. Jose Hector Livia Segovia Director del Instituto Central de Gestion de Investigacion		 Dra. Graciela Monroy Correa Jefa de la Oficina de Investigacion de Proyectos		



FORMATO N° 4			
AUTORIZACIÓN PARA REALIZAR EL PAGO PREVIO A LA PUBLICACIÓN POR DERECHO A LA REVISTA INDEXADA			
1	FECHA DE EMISIÓN DEL DOCUMENTO	13/03/2024	
2	DEPENDENCIA USUARIA	INSTITUTO CENTRAL DE GESTION DE LA INVESTIGACION	
3	DATOS DEL PROVEEDOR	Razón Social	MDPI
		RUC / Código	PROVEEDOR DEL EXTRANJERO
		Dirección	SUIZA
		Nombre de contacto	Pedro Arias-Sánchez
		Número telefónico	+41616837734
		E-mail	<a href="https://www.mdpi.com/journal/sustainability">https://www.mdpi.com/journal/sustainability</a>
4	DATOS DE LA CONTRATACIÓN	Ítem	1
		Descripción del objeto de la contratación	"SERVICIO DE PUBLICACIÓN DE ARTÍCULO EN REVISTA INDIZADA INTERNACIONAL"
		Monto de la contratación	S/.11,400.00
		Forma de pago	PAGO PREVIO
		Plazo de la prestación	HASTA CIEN DIAS CALENDARIOS SIGUIENTES CONTADOS A PARTIR DEL DIA SIGUIENTE DE RECIBIDO EL PAGO CORRESPONDIENTE
		Validación de TdR	SEGÚN FORMATO ADJUNTO
6	OBSERVACIONES		
	PROVEEDOR CON SEDE EN SUIZA		
7	AUTORIZACIÓN EN CASO DE REALIZAR EL PAGO PREVIO A LA PUBLICACIÓN		
	El funcionario que suscribe el presente documento, dada la naturaleza de la contratación autoriza la realización del pago previo a la publicación, a fin de alcanzar la finalidad de la contratación.		
	CONDICIONES PARA EL PAGO PREVIO	Monto a pagar	S/.11,400.00
		Plazo para realizar el pago	30 DIAS CALENDARIOS
		Nombre y dirección del banco destino	UBS SWITZERLAND AG, Bahnhofstrasse 45, 8001 Zurich Switzerland
		Nombre de cuenta	MDPI AG
		Número de cuenta	023300222721.62C
		CCI / Código Swift	UBSWCHZH80A
		Código ABA / IBAN	CH92 0023 3233 2227 2162C
Otras consideraciones	-----		
8	<div><div> Dr. Jose Hector Livia Segovia Director del Instituto Central de Gestion de Investigacion</div><div> Dra. Graciela Monroy Correa Jefa de la Oficina de Investigación de Proyectos</div></div> <div>NOMBRE, FIRMA Y SELLO DEL FUNCIONARIO RESPONSABLE DEL ÁREA USUARIA</div>		



## Formato 12

### FICHA TECNICA DE LA REVISTA

<b>Nombre</b>	INFRASTRUCTURES - MDPI
<b>URL</b>	<a href="https://www.mdpi.com/journal/infrastructures">https://www.mdpi.com/journal/infrastructures</a>
<b>ISSN</b>	2412-3811
<b>Indexaciones</b>	Scopus, SCIE y SSCI (Web of Science), Gale, Inspec OpenAIRE, PATENTSCOPE y otras bases de datos.
<b>Año de publicación</b>	2009
<b>Periodicidad</b>	SEMI MENSUAL
<b>Editor</b>	Pedro Arias-Sánchez
<b>Factor de impacto</b>	2,6 (2022)
<b>Cuartil de la revista</b>	CiteScore - Q2 (Building and Construction)
<b>Entidad patrocinadora</b>	MDPI
<b>País</b>	Suiza



ANEXO N° 06: APROBACIÓN DE MODIFICACIONES AL CUADRO MULTIANUAL DE NECESIDADES N° 00000207

UNIDAD EJECUTORA : 001 UNIVERSIDAD NACIONAL FEDERICO VILLARREAL  
NRO. IDENTIFICACIÓN : 000102

Fecha de Solicitud	N° de Solicitud de Modificación	Código Ítem N.-	Descripción del Ítem	Unidad de Medida	CANTIDAD Y/O VALORES			
					EXCLUSIÓN		INCLUSIÓN	
					Cantidad Total	Valor Total S/	Cantidad Total	Valor Total S/
102.04.03.1 - Instituto Central De Gestión De La Investigacion- Vrin								
13/03/2024	0000000297	150100020007	PUBLICACIONES DE ARTÍCULOS CIENTÍFICOS EN REVISTA INTERNACIONAL	Servicio	0.00	0.00	0.00	11,400.00

- 1/ La información registrada en el presente Anexo corresponde a campos mínimos y obligatorios que pueden ser ampliados por la Entidad del Sector Público u organización de la entidad.
- 2/ La información registrada en los campos de "exclusión" e "inclusión" considera la cantidad y/o valor acumulado de todos los años de la programación.
- 3/ El campo de "cantidad total" se completa solo en el caso de bienes.
- 4/ La presente información tiene carácter de Declaración Jurada; por lo que, en señal de conformidad y en representación de la Entidad del Sector Público u organización de la entidad, se suscribe:



Firma 1: Responsable del Área involucrada en la gestión de la CAP



Firma 2: Titular de la Entidad u Organización de la entidad, o a quien se hubiera delegado dicha facultad

ANEXO N° 05: SOLICITUD DE MODIFICACIÓN DEL CUADRO MULTIANUAL DE NECESIDADES N° 0000000297

UNIDAD EJECUTORA : 001 UNIVERSIDAD NACIONAL FEDERICO VILLARREAL  
NRO. IDENTIFICACIÓN : 000102

Centro de Costo: 102.04.03.1 INSTITUTO CENTRAL DE GESTIÓN DE LA INVESTIGACION- VRIN  
Fecha de Solicitud: 13/03/2024

ÍTEM			CANTIDAD Y/O VALORES			
Código Ítem N.-	Descripción del Ítem	Unidad de Medida	EXCLUSIÓN		INCLUSIÓN	
			Cantidad Total	Valor Total S/	Cantidad Total	Valor
150100020007	PUBLICACIONES DE ARTÍCULOS CIENTÍFICOS EN REVISTA INTERNACIONAL	Servicio	0	0.00	0	

Sustento para la aprobación de modificaciones del CMN, al día hábil siguiente de su presentación (numeral 27.4 del artículo 27):  
De ser el caso, indicar el/los año(s) que corresponda(n) realizar la inclusión o exclusión de la programación:

- 1/ La información registrada en el presente Anexo corresponde a campos mínimos y obligatorios que pueden ser ampliados por la Entidad del Sector Público u organización de la entidad.
- 2/ La información registrada en los campos de "exclusión" e "inclusión" considera la cantidad y/o valor acumulado de todos los años de la programación.
- 3/ El campo de "cantidad total" se completa solo en el caso de bienes.
- 4/ La presente información tiene carácter de Declaración Jurada; por lo que, en señal de conformidad y en representación del Área usuaria, se suscribe:



Firma: Responsable del Área Usuaría



## INSTITUTO CENTRAL DE GESTIÓN DE LA INVESTIGACIÓN

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PROVEIDO N° 225-2024-ICGI-VRIN-UNFV

RECURRENTE: Bach. MANUEL ORTIZ CHAVEZ  
Jefe Unidad Contrataciones y Servicios Básicos

ASUNTO: REMITO EXPEDIENTE CON APROBACIÓN DE ANEXO 06  
PARA EL SERVICIO DE PUBLICACIÓN DE  
TRANSPORTATION SYSTEM AND THE IMPROVEMENT OF  
URBAN VEHICULAR 3 FLOW IN THE DISTRICT OF HUÁNUCO-  
PERÚ 2022.

REFERENCIA: OFICIO N° 1063-2024-UCSB-OASG-UNFV

NT: 15824-2024

FECHA : Lima, 26 de marzo del 2024

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PASE A : **Dra. Graciela M. Monroy Correa**  
Jefa de la Oficina de Proyectos de investigación.

PARA : Su atención y fines correspondiente.

  
**Dr. JOSÉ H. LIVIA SEGOVIA**  
Director

Instituto Central de Gestión de la Investigación

**Cc. CARLOS DOMINGUEZ**  
Adj.: 054 folios



**UNIDAD DE CONTRATACIONES Y SERVICIOS BASICOS**

*"Año del Bicentenario, de la consolidación de nuestra Independencia, y de la conmemoración de las Heroicas Batallas de Junín y Ayacucho"*

Pueblo Libre, 25 de marzo de 2024

**OFICIO N° 1063-2024-UCSB-OASG-UNFV**

**Dr. JOSE HECTOR LIVIA SEGOVIA**

Director del Instituto Central de Gestión de la Investigación

Presente. –

**Asunto:** REMITO EXPEDIENTE CON APROBACIÓN DE ANEXO 06 PARA EL SERVICIO DE PUBLICACIÓN DE TRANSPORTATION SYSTEM AND THE IMPROVEMENT OF URBAN VEHICULAR 3 FLOW IN THE DISTRICT OF HUÁNUCO-PERÚ 2022

**Referencia:** PROVEIDO N° 3330-2024-DIGA-UNFV

Es grato dirigirme a usted para saludarle cordialmente y, en atención al documento de la referencia poner de conocimiento que la Dirección General de Administración procedió con la aprobación del anexo 06 para el SERVICIO DE PUBLICACIÓN DE TRANSPORTATION SYSTEM AND THE IMPROVEMENT OF URBAN VEHICULAR 3 FLOW IN THE DISTRICT OF HUÁNUCO-PERÚ 2022.

Aprovecho la ocasión para renovarle las muestras de mi especial consideración y estima personal.

Atentamente,



V°B°

**LIC. JULIO GREGORIO TALLA RAMOS**

Jefe

Oficina de Abastecimiento y Servicios Generales



**Bach. MANUEL JESUS ORTIZ CHÁVEZ**

Jefe

Unidad de Contrataciones y Servicios Básicos

MOCH/nbch  
NT: 15824-2024

""

**PROVEIDO N° 3330-2024-DIGA-UNFV**

**RECURRENTE** LIC. JULIO GREGORIO TALLA RAMOS  
OFICINA DE ABASTECIMIENTO Y SERVICIOS GENERALES - OASG  
OFICIO N° 1026-2024-UCSB-OASG-UNFV

**NT** 015824 - 2024

**ASUNTO** SOLICITUD DE APROBACION DE ANEXO 06

**FECHA** 22 DE MARZO DEL 2024

**DESTINATARIO** LIC. JULIO GREGORIO TALLA RAMOS  
OFICINA DE ABASTECIMIENTO Y SERVICIOS GENERALES - OASG

**PARA** SE REMITE ANEXO N° 06: APROBACIÓN DE MODIFICACIONES AL CUADRO  
MULTIANUAL DE NECESIDADES N° 00000207, APROBADO EN EL SIGA, A FIN  
QUE, SE SIRVA INFORMAR AL AREA USUARIA DE ACUERDO A LOS  
LINEAMIENTOS ESTABLECIDOS Y NORMATIVA VIGENTE.

ATENTAMENTE,



**ECON. JOSÉ GUALBERTO CONDORI QUÍSPE**  
JEFE

JGCQ / rdly

**FOLIOS:** 01



**UNIDAD DE CONTRATACIONES Y SERVICIOS BASICOS**

*"Año del Bicentenario, de la consolidación de nuestra Independencia, y de la conmemoración de las heroicas batallas de Junín y Ayacucho"*

Pueblo Libre, 20 de marzo del 2024

**OFICIO N° 1026-2024-UCSB-OASG-UNFV**

Señor Economista.

**JOSE GUALBERTO CONDORI QUISPE**

Jefe de la Dirección General de Administración

Correo : [diga@unfv.com.pe](mailto:diga@unfv.com.pe)

Presente.-

**Asunto:** Aprobación de Anexo 05 - Solicitud de  
Modificación del Cuadro Multianual de  
Necesidades

**Referencia:** MEMORANDO N° 026-2024-DIGA-UNFV

Es grato dirigirme a usted para saludarlo muy cordialmente y a la vez, en atención al documento de la referencia, se remite la aprobación de ANEXO N° 05: SOLICITUD DE MODIFICACIÓN DEL CUADRO MULTIANUAL DE NECESIDADES, sobre los requerimientos de las áreas usuarias que a continuación se detalla

N°	NT	Área Usuaría	Descripción del Bien / Servicio	Clasificador de gasto	Anexo 05 N°	Anexo 06 N°	Modif	Cant Total	Valor Total S/.
01	20585	OCGTI	Servicio de elaboración de informe técnico del sistema eléctrico y subestación	23.29.11	306	204	inclusión		4,000
02	13014	VRIN	Publicación de revista Use of Digital Tools (Wikihouse System) in Multi-Local Social Housing	23.22.41	301	205	inclusión		15,200
03	15824	VRIN	Publicación de revista Transportation system and the improvement of urban vehicular 3 flow in the district of Huánuco-Perú 2022	23.22.41	297	207	inclusión		11,400
04	15127	FAU	Equipo para aire acondicionado portátil de 15000 btu	26.32.91	278	203	inclusión	5	
05	15280	OASG	Adq herramientas para pintados aulas - predios UMTS - OASG - UNFV	23.199.199 23.199.199 23.199.11 23.199.11	312	206	inclusión	100 30 60 45	
6	18687	OASG	Acondicionamiento de archivos móviles locais SL014	2.3.24.21	318	208	inclusión		171,000.01
7	7648	EU	Mantenimiento Máquinas de Imprenta – E. U	2.3.24.71	302 304 303 305	215 214 213 212	inclusión		4,978.00 4,374.00 5,962.00 2,945.00
8	20308	BC	Servicio de suscripción a base de datos de publicaciones académicas y científicas	2.3.27.499	62	216	inclusión		335,900.00
9	20662	EU	Servicio de mantenimiento correctivo de la máquina laminadora - marca LH	2.3.24.71	309	211	inclusión		3,383.00





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*"Año del Bicentenario, de la consolidación de nuestra Independencia, y de la conmemoración de las heroicas batallas de Junín y Ayacucho"*

			ELECTRONIC						
10	20663	EU	Servicio de Mantenimiento Correctivo de la Máquina ATF-Marca DAVIDSON 701	2.3.24.71	308	210	inclusión		5,922.00
11	21807	OI	Compra de tóner de impresión kyocera cod. ref. TK 6347 negro	2.3.15.12	326	209	inclusión	2	
12	16420	IREDA	Adquisición de buzos para delegaciones deportivas UNFV	2.3.12.11	319	219	exclusión	50	
13	09580	FIC	Contratación por Locación de Servicios	232911	227	217	Inclusión		7,200.00
14	022224	UMTS - OASG	Contratación por Locación de Servicios						
			NARREA CHAMAN JORGE LUIS		341				5,400.00
			RIVERA GUTIERREZ LUIS MIGUEL		342				4,500.00
			RUIZ PACHECO BRYAN CARLOS		343				3,600.00
			DE LA CRUZ QUISPE MARIO JAVIER	232911	344	218	Inclusión		4,500.00
			VASQUEZ HURTADO JUAN CARLOS		345				6,000.00
			BUENALAYA AQUINO EDGAR		346				6,000.00
15	022224	UCSB - OASG	Contratación por Locación de Servicios de BONIFACIO CHAVEZ NELSON ANDRE	232911	348	220	Inclusión		15,000.00
16	022224	UCSB - OASG	Contratación por Locación de Servicios de BEJAR ATOCHE YOLANDA DE LAS NIEVES	232911	348	221	Inclusión		15,000.00

Por consiguiente y a fin de continuar con la atención del expediente, se remite los ANEXO N° 06: APROBACIÓN DE MODIFICACIONES AL CUADRO MULTIANUAL DE NECESIDADES, generados a partir de los Anexos N° 05 solicitado por las áreas usuarias mencionadas, **para su aprobación**, y así poder remitir a las áreas usuarias para conocimiento y fines pertinentes.

Sin otro particular, aprovecho la ocasión para renovar las muestras de mi especial consideración y estima personal.

Atentamente,



**Bach. MANUEL ORTIZ CHÁVEZ**

Jefe

Unidad de Contrataciones y Servicios Básicos

V°B°

**LIC. JULIO GREGORIO TALLA RAMOS**

Jefe

Oficina de Abastecimiento y Servicios Generales

NT: 20585, 13014, 15824, 15127, 15280, 18687, 7648, 20308, 20662, 20663, 21807, 16420, 09580, 022224

MJOCH/nbch

ANEXO N° 06: APROBACIÓN DE MODIFICACIONES AL CUADRO MULTIANUAL DE NECESIDADES N° 00000207

UNIDAD EJECUTORA : 001 UNIVERSIDAD NACIONAL FEDERICO VILLARREAL  
NRO. IDENTIFICACIÓN : 000102

Fecha de Solicitud	N° de Solicitud de Modificación	Código Ítem N.-	Descripción del Ítem	Unidad de Medida	CANTIDAD Y/O VALORES			
					EXCLUSIÓN		INCLUSIÓN	
					Cantidad Total	Valor Total S/	Cantidad Total	Valor Total S/
102.04.03.1 - Instituto Central De Gestión De La Investigacion- Vrin								
13/03/2024	0000000297	150100020007	PUBLICACIONES DE ARTÍCULOS CIENTÍFICOS EN REVISTA INTERNACIONAL	Servicio	0.00	0.00	0.00	11,400.00

- 1/ La información registrada en el presente Anexo corresponde a campos mínimos y obligatorios que pueden ser ampliados por la Entidad del Sector Público u organización de la entidad.
- 2/ La información registrada en los campos de "exclusión" e "inclusión" considera la cantidad y/o valor acumulado de todos los años de la programación.
- 3/ El campo de "cantidad total" se completa solo en el caso de bienes.
- 4/ La presente información tiene carácter de Declaración Jurada; por lo que, en señal de conformidad y en representación de la Entidad del Sector Público u organización de la entidad, se suscribe:



Firma 1: Responsable del Área involucrada en la gestión de la CAP

Firma 2: Titular de la Entidad u Organización de la entidad, o a quien se hubiera delegado dicha facultad



INSTITUTO CENTRAL DE GESTIÓN DE LA INVESTIGACIÓN

"Año del Bicentenario, de la consolidación de nuestra Independencia,  
y de la conmemoración de las heroicas batallas de Junín y Ayacucho"

Lima, 13 de marzo del 2024

Oficio N° 076-2024-OPI-ICGINV-VRIN-UNFV.

**Lic. JULIO TALLA RAMOS**

Jefe de la Oficina de Abastecimiento y Servicios Generales.

Presente. -

**ASUNTO:** FINANCIAMIENTO DE ARTÍCULO CIENTÍFICO.

Tenemos a bien dirigirnos a usted para saludarlo cordialmente y a la vez remitir el expediente de requerimiento para FINANCIAMIENTO DE ARTÍCULO CIENTÍFICO, la misma que necesita ser aprobada por la oficina de Abastecimiento y la posterior autorización de la DIGA, para este efecto se adjunta el Anexo N° 05: Solicitud de Modificación del Cuadro Multianual de Necesidades N° 000297.

Cumplido el trámite respectivo, solicitamos devolver el expediente para continuar con la gestión de financiamiento del artículo: Transportation system and the improvement of urban vehicular 3 flow in the district of Huánuco-Perú 2022.

Esta publicación se financia con cargo a la actividad financiada con recursos ordinarios (SUBVENCIÓN DE PAGO POR CARGO DE PROCESAMIENTO DE ARTÍCULOS EN REVISTAS DE IMPACTO).

Sin otro particular es propicia la oportunidad para renovarles las muestras de mi especial consideración y estima.

Atentamente,



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**Dra. Graciela Martina Monroy Correa**  
Jefa Oficina de Proyectos de Investigación



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**Dr. JOSE HECTOR LIVIA SEGOVIA**

Director del Instituto Central  
de Gestión de la Investigación

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NT: 015824

Total S/
11,400.00

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03/2024

12

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[illegible]

ANEXO N° 03: Cuadro Multianual de Necesidades - Servicios - Fase de Consolidación y Aprobación  
(Actualizado en atención al PIA)

UNIDAD EJECUTORA : 001 UNIVERSIDAD NACIONAL FEDERICO VILLARREAL  
NRO. IDENTIFICACIÓN : 000102  
CENTRO DE COSTO : 102.04.03.1 - INSTITUTO CENTRAL DE GESTIÓN DE LA INVESTIGACION- VRIN

					CANTIDAD Y/O VALORES															
FF/Rb		Clasificador de Gastos	Actividad Operativa	Meta	2024				2025				2026				2027			
Código del Ítem	Tipo	Descripción del Ítem	Unidad de Medida	Precio Unitario	Semestre 1		Semestre 2		Semestre 1		Semestre 2		Semestre 1		Semestre 2		Semestre 1		S	
					Cantidad	Valor Total S/	Cantidad	Valor Total S/	Cantidad	Valor Total S/	Cantidad	Valor Total S/	Cantidad	Valor Total S/	Cantidad	Valor Total S/	Cantidad	Valor Total S/		
PROGRAMACIÓN: C.M.N.					1,314,633.98		36,920.02		75,339.00		38,625.00		76,482.00		39,768.00		0.00			
2-09 RECURSOS DIRECTAMENTE RECAUDADOS					38,714.00		3,000.00		39,714.00		3,000.00		39,714.00		3,000.00		0.00			
Meta: 0024 - INVESTIGACION CIENTIFICA Y TECNOLOGICA					38,714.00		3,000.00		39,714.00		3,000.00		39,714.00		3,000.00		0.00			
Actividad Operativa: C0369 - ACTIVIDADES ADMINISTRATIVAS QUE APOYAN EL DESARROLLO DE LAS ACTIVIDADES ACADÉMICAS					8,000.00		3,000.00		8,000.00		3,000.00		8,000.00		3,000.00		0.00			
2.3. 2 4. 7 1 DE MAQUINARIAS Y EQUIPOS					8,000.00		3,000.00		8,000.00		3,000.00		8,000.00		3,000.00		0.00			
60100001000	S	MANTENIMIENTO CORRECTIVO DE EQUIPO DE AIRE ACONDICIONADO	SERVICIO		0.00		3,000.00		0.00		3,000.00		0.00		3,000.00		0.00			
60350001005	S	MANTENIMIENTO PREVENTIVO DE FOTOCOPIADORA	SERVICIO		5,000.00		0.00		5,000.00		0.00		5,000.00		0.00		0.00			
60350001007	S	MANTENIMIENTO CORRECTIVO DE SURTIDOR DE AGUA ELECTRICO - DISPENSADOR ELECTRICO	SERVICIO		3,000.00		0.00		3,000.00		0.00		3,000.00		0.00		0.00			
Actividad Operativa: C0372 - EVENTOS DE INVESTIGACIÓN					12,714.00		0.00		13,714.00		0.00		13,714.00		0.00		0.00			
2.3. 2 9. 1 1 LOCACION DE SERVICIOS REALIZADOS POR PERSONAS NATURALES RELACIONA					12,714.00		0.00		13,714.00		0.00		13,714.00		0.00		0.00			
07110043029	S	SERVICIO DE ATENCIÓN Y CONTROL DE CAPACITACIONES, EVENTOS Y TALLERES	SERVICIO		12,714.00		0.00		13,714.00		0.00		13,714.00		0.00		0.00			
Actividad Operativa: C0373 - PROYECTOS DE INVESTIGACIÓN CON INCENTIVO					18,000.00		0.00		18,000.00		0.00		18,000.00		0.00		0.00			
2.3. 2 9. 1 1 LOCACION DE SERVICIOS REALIZADOS POR PERSONAS NATURALES RELACIONA					18,000.00		0.00		18,000.00		0.00		18,000.00		0.00		0.00			
07110038851	S	SERVICIO DE JURADO EVALUADOR DE PROYECTOS DE INVESTIGACIÓN	SERVICIO		18,000.00		0.00		18,000.00		0.00		18,000.00		0.00		0.00			
TOTAL GENERAL S/					1,314,633.98		36,920.02		75,339.00		38,625.00		76,482.00		39,768.00		.00			

La presente información tiene carácter de Declaración Jurada, por lo que en señal de conformidad y en representación del área usuaria se suscribe:



Firma: Responsable del área usuaria

03/2024

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Semestre 2		
Ítem	Valor	Total S/
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Lima Cercado, 05 de marzo de 2024

**OFICIO N°067-2024-OPI-ICGI-VRIN-UNFV**

Señor Doctor  
**JOSÉ LIVIA SEGOVIA**  
Director  
Instituto Central de Gestión de la Investigación  
Presente. –

**Asunto:** Solicitud de financiamiento para publicación de artículo en la revista INFRAESTRUCTURES – DRA. DORIS ESENARRO – FIGAE

**Referencia:** Proveído 137-2024-ICGI-VRIN-UNFV

**NT:** 015824-2024

Tengo el agrado de saludarlo cordialmente y en atención al Proveído 137-2024-ICGI, emitido por vuestro Despacho; informarle que el expediente referido no cumple con el reglamento para financiamiento de publicaciones que solicita la Dra. Doris Esenarro (FIGAE), dado que no adjunta el artículo.

Sin otro particular, es propicia la ocasión para renovar mi consideración.

Atentamente,



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**Dra. Graciela Monroy Correa**  
**Jefa (e)**  
**Oficina de Proyectos de Investigación**



“Año del Bicentenario de la consolidación de nuestra independencia, y de la  
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## **INSTITUTO CENTRAL DE GESTIÓN DE LA INVESTIGACIÓN**

---

PROVEIDO N° 137-2024-ICGI-VRIN-UNFV

RECURRENTE: Dr. PEDRO MANUEL AMAYA PINGO  
VICERRECTOR DE INVESTIGACIÓN.

ASUNTO: SOLICITUD DE FINANCIAMIENTO DE ARTICULO  
DRA. DORIS ESENARRO VARGAS

REFERENCIA: PROVEIDO N° 242-2024-VRIN-UNFV

**NT 15824-2024**

FECHA : Lima, 01 marzo del 2024

---

PASE A : **Dra. GRACIELA M. MONROY CORREA**  
Jefa de la Oficina de Proyecto de Investigación.

PARA : Su informe por lo solicitado por VRIN.

  
**Dr. JOSÉ H. LIVIA SEGOVIA**  
Director  
Instituto Central de Gestión de la Investigación



**VICERRECTORADO DE INVESTIGACIÓN**

“Año del Bicentenario, de la consolidación de nuestra Independencia, y  
de la conmemoración de las heroicas batallas de Junín y Ayacucho”

**PROVEIDO N° 242 -2024-VRIN-UNFV**

RECURRENTE : DRA. DORIS ESENARRO VARGAS  
DOCENTE DE LA FACULTAD DE INGENIERÍA GEOGRÁFICA,  
AMBIENTAL Y EN ECOTURISMO

REFERENCIA : FORMULARIO ÚNICO DE TRÁMITE

NT : 015824 - 2024

ASUNTO : SOLICITUD DE FINANCIAMIENTO DE ARTÍCULO  
“TRANSPORTATION SYSTEM AND THE IMPROVEMENT OF  
URBAN VEHICULAR FLOW IN THE DISTRICT OF HUANUCO-PERU 2022”

FECHA : SAN MIGUEL, 28 DE FEBRERO DE 2024

---

PASE A : DR. JOSÉ HÉCTOR LIVIA SEGOVIA  
JEFE DEL INSTITUTO CENTRAL DE GESTIÓN DE LA INVESTIGACIÓN

PARA : SU OPINIÓN E INFORME TÉCNICO.

ATENTAMENTE,

  
DR. PEDRO MANUEL AMAYA PINGO  
VICERRECTOR DE INVESTIGACIÓN

V°B° Dr. Jose H. Liia Segovia

Carta de aceptación remitida por el proveedor:





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Name of co-authors: Yessica Julia Verastegui and DORIS Esenarro  
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## Article

# Transportation system and the improvement of urban vehicular flow in the district of Huánuco-Perú 2022

Yessica Verastegui <sup>1,2,\*</sup>, Doris Esenarro <sup>1,3</sup><sup>1</sup> Federico Villarreal National University-Graduate School; Lima-Perú; 2020001237@unfv.edu.pe (Y.V.); 2020001228@unfv.edu.pe (G.V.); desenarro@unfv.edu.pe (D.E.)<sup>2</sup> University of Huánuco-Graduate School; Huánuco-Perú; yessica.verastegui@udh.edu.pe (Y.V.); gaby.verastegui@udh.edu.pe (G.V.)<sup>3</sup> INERN UNFV Specialized Institute of Ecosystems and Natural Resources Investigation

\* Correspondence: 2020001237@unfv.edu.pe

**Abstract:** The objective of this research is to propose a ~~model for designing a transportation system to enhance urban vehicular flow~~ public transport reorganization system that allows the improvement of urban vehicle flow. The lack of adequate transportation infrastructure and the existing disorder in the services provided by collective car, Microbus, Rural Public Transportation Van (Combi), Coaster, and mototaxis generate congestion in public transportation, especially during peak hours, resulting in environmental and noise pollution. The research was structured into four stages: data collection on the public and private transportation network, importing and creating the transportation network in the urban area of the Huánuco district, zoning and connectivity of the study area, and finally, creating the origin/destination (O/D) matrix for public transportation, supported by digital tools (ArcGIS, AutoCAD, Excel). To meet the demand of 135,343 passengers from South to North and 118,958 from North to South, the proposal includes establishing 1 main route and 7 feeder routes, requiring 422 buses and road infrastructure, as depicted in Figures 17 to 19. This system will have exclusive lanes to operate the Mass Transit System, allowing it to accommodate 59% of users who prefer using public transportation. This proposal aims to offer an efficient and high-quality transportation system.

**Keywords:** Transportation System, Vehicular Flow, Improvement, Urban Transportation.

**Citation:** To be added by editorial staff during production.

Academic Editor: Firstname Last-name

Received: date

Revised: date

Accepted: date

Published: date



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## 1. Introduction

The development of society, the influence of transportation, as well as their corresponding relationships, have become so complex that their use without proper state organization becomes uncertain [1]. Since 2014, there has been an average vehicle growth of 3% in Latin America and a trend indicating a doubling of currently existing vehicles in the next 25 years, considering this trend from 2014. Faced with this issue, only plans that remain pending or are not being correctly implemented in urban traffic are left. Vehicular noise is a problem to which we give little importance but has an impact on public health, causing issues such as stress, headaches, and irritability, among others. It's well-known that for the World Health Organization (WHO), the optimal limit for street noise should constantly be 30 dB, but this is not met in reality, and in many cities, noise levels exceed 80 dB at their most critical traffic points [2].

Transportation is one of the primary and largest air pollutants in the world. Several studies show that fuel combustion emits multiple pollutants, which can severely affect the lungs of growing children, leading to a decrease in lung function [2].

The transition to a competitive economy with low carbon emissions means that the EU must be prepared to ensure that, by 2050, it will reduce its internal emissions by 80% compared to 1990. The European Commission has conducted extensive model analyses



with various possible scenarios showing how these objectives could be achieved. This analysis of different scenarios demonstrates that in terms of profitability, it would be optimal to achieve an internal emission reduction of 40% by 2030 compared to the 1990 level and 60% by 2040. The reduction in emissions is 25%. Thus, an annual reduction of approx. 1% would be achieved in the first decade by 2020, compared to the 1990 level. In the second decade from 2020 to 2030, there would be a reduction of 1.5%, and in the last two decades by 2050, there would be a reduction of 2%. It is expected that with the increased availability of more cost-effective technologies, efforts will be intensified, particularly in the transportation sector [3].

In the 2030 Agenda for Sustainable Development, sustainable transport is mainstreamed across several Sustainable Development Goals (SDGs) and targets. Specifically, target 11.2 is aimed at providing “access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons” [4].

Accessibility to public transportation in cities increases with population growth and geographical expansion. Recent poorly applied transportation planning techniques have led to unequal access distribution, resulting in insecurity and environmental pollution, while favoring private transportation and neglecting local and non-motorized public transportation [5]. According to Raheem et al., 2015, traffic congestion is defined as vehicles moving slowly due to limited road capacity. In simpler terms, congestion occurs when traffic demand approaches or exceeds road network capacity [6]. According to Feng, X et al., 2016, It's a global phenomenon caused by high population density, growth in motorized vehicles, and inadequate road infrastructure planning. Regular traffic conflicts often occur, mainly due to excessive traffic during peak hours [7]. The current assessment of the quality of public transportation services in a developing city like Gazipur helps transportation experts make better decisions about future transportation systems to improve service quality, mobility, reduce pollution, and ensure dynamic urban living [8].

In the analysis of Karachi city, the lack of efficient public transportation is due to the extremely low cost of available cars for all types of Karachi residents, leading to excessive car usage and simultaneously increasing dependency on private cars, resulting in severe issues: accidents, congestion, and economic, social, and environmental impact [9]. Traffic jams occur not only in metropolises and large cities but also in medium-sized cities like Starogard Gdansk, where traffic congestion has a negative impact on developing economies, society, and the environment [10].

Similarly, in Saltillo, Coahuila, like many other cities worldwide, it has been a victim of an inadequate public transportation system for many years, and the outcomes of its initiatives have not resulted in a good transportation system, be it due to the lack of an adequate public transportation system, insufficient operator training, inadequate vehicle supply and service offerings, users unable to plan routes due to inconsistent schedules, etc. [11]. India is going through the same phase of early urbanization that has already occurred in countries like Japan, Republic of Korea, and Singapore. The increase in traffic volumes on urban roads has led to almost all intersections being fully congested. Long queues and traffic signal failures are quite common during peak hours. It is also expected that the per capita travel rate for all modes of transport would increase from 0.8 to 1.55 in 2007 and is expected to be from 1 to 2 by 2030 [12].

The compact yet expanding city within its unsustainable growth generates longer distances. In this case, alternative models may not seem viable, but it's time to consider them. It's worth noting that the volume of both public and private vehicles circulating in a city generates several problems, one of which is related to air pollution that meets and exceeds national air quality standards. Pollution not only affects the health of inhabitants and the vitality of the city but also causes various physical damages to historical buildings [3].

Traffic congestion is an obstacle for any developing society and affects the country's productivity level, as people can take more than two hours to commute to work and return home, impacting their work performance and their physical and mental health [13], [14].

Current urban mobility is causing a series of environmental conflicts highlighted globally, most of which are linked to the use of motorized transportation, responsible for energy consumption, land fragmentation due to road construction, as well as noise and air pollution. Air quality is monitored in some cities worldwide, but in Latin America, particularly in Mexico, the number of cities attentive to this environmental impact is limited, while negative impacts on human health and ecosystems increase [15].

According to reports from Dirtepol Huánuco, in the capital of the Huánuco department, an average of 25,000 vehicles circulates daily, including motorcycles, three-wheelers, and cars. Of this total, around 13,500 are registered and operate with municipal authorization, while the rest continue to operate informally, causing vehicular congestion in the city's main streets [16].

In the city of Huánuco, traffic issues are so complex that other related problems arise and worsen. One of the most serious issues in Huánuco is passenger public transportation. These problems lead to inadequate urban transportation services for users, generating disorder, wasted travel time for both drivers and road users, vehicle congestion, and environmental pollution in the urban area of the Huánuco district, due to a lack of regulation, legislation, and deficient road infrastructure in the urban area of the district.

Comparing with the aforementioned regulation (Supreme Decree No. 085 - 2003 - PCM) and according to the monitoring conducted, we have observed that in most of the assessments, the noise generated in the different detected points has reached extremely high levels, nearly doubling the standard for that type of area and time [17].

According to Dionisio et al., vehicle congestion of all types in the city has worsened over the past five years, leading to severe air pollution. Due to the lack of public spaces in the urban area, residents leave the city towards the banks of the Huallaga and Higuera rivers in search of recreational spaces, as mentioned by Contreras Ella [18].

The Huánuco district, whose CO emissions accumulated during the years 2019-2022 have decreased, except for the year 2020. Additionally, it can be indicated that, in the analyzed periods, the highest gas concentrations are found in the central and northeastern part of the province, mainly due to the location of several district capitals and human activities taking place in these areas. Moreover, the northeast zone shows a distribution of localities justifying the increase in activities generating CO [19].

Therefore, the objective of this research is to propose a model for designing an urban transportation system to improve vehicular flow, aiming to mitigate vehicular congestion and its associated issues such as environmental and noise pollution.

The report from the Huánuco Transportation Directorate indicates that there are more than 20 thousand trimobles of which only 8,200 vehicles are registered as formal in the municipality of Huánuco [20].

The sound levels are relative, reaching up to 78 decibels and do not comply with the regulations or national environmental quality standards for noise (Supreme Decree No. 085, 2003), causing noise pollution in the mornings [21].

According to the interview conducted with Engineer Jorge Luis Escalante Soplin, Transportation Manager of the Provincial Municipality of Huánuco, In the city of Huánuco, 90% of the roads are paved. In the city of Huánuco there is no access to bicycle lanes except of the exit to the Kotosh Archaeological Site, he also stated that in the urban center of Huánuco there are 76 authorized stops, most of which have been generating traffic congestion.

The increase in commercial and economic activities, such as the construction of new shopping centers, which have become poles of attraction (migratory flows) due to popu-



lation growth, the increase in vehicular transportation, education, health care, cause persistent problems of traffic congestion and aggravate the urban public. Inhaled carbon monoxide can combine with blood hemoglobin and reduce the oxygen-carrying capacity of the human body, and long-term exposure causes heart disease, edema, severe lung congestion, and nausea, among others [22].

It was possible to evaluate the noise intensity in 12 points of vehicle congestion identified in the urban area of the Amarilis district, belonging to the metropolitan area of Huánuco, in which it was determined that the noise intensity exceeds the ECA for noise (D.S No. 085-2003-PCM) and the WHO standards in daytime, the evaluation was carried out for a period of 4 weeks, with monitoring 2 days a week [23].

~~According to the Proexpansión study (2008),~~ One of the main consequences of the chaotic transportation system is the loss of time. This directly affects the economy of users, who lose productive hours when traveling to their workplaces (CAF, 2011). If this loss of time is broken down among users of motorized vehicles, the greatest cost of time is assumed by users of conventional public transportation, who do not have the privilege of passing over private vehicles (Proexpansión, 2008) ~~as cited Juan Carlos Dextre, Fiorella Aranda [24]~~

Therefore, the objective of this research is public transport reorganization system that allows the improvement of urban vehicle flow.

## 2. Literature Review.

Over the last several decades, mass transit authorities have sought ways to increase transit ridership while also improving transit service quality and operational efficiency. Reflecting this mindset, much of the existing literature focuses on the development of analytical tools/ methods intended to improve utilization of transit vehicles, drivers, and/or other resources (including maintenance crews and funding). [25]

ChiraChavala and Venter analyzed the impact of automated vehicle- and passenger-scheduling methods on the operating costs of paratransit systems. They found that such methods reduced unit paratransit transportation cost by 13%. Further extending the earlier work of Chira-Chavala and Venter, Pagano et al. assessed the impact of the computer-assisted scheduling and dispatching (CASD) systems on the service quality of paratransit services in central Illinois. They found that CASD systems allowed passengers to enjoy less riding time and more on-time services at both pickups and drop-offs and subsequently enhanced their overall satisfaction with paratransit services [25]

The CLIMATRANS report which talks about the detailed mitigation policy bundles to be implemented for sustainable transportation in Bengaluru, emphasizes on policies for better walking and cycling infrastructure and suggests the measures such as congestion pricing, car-pooling and mixed land use development. The study also talks about the positive environmental effects (such as reduced NOx and COx emissions) due to policies like High Occupancy Vehicle (HOV) lanes in the outer periphery of the city including outer ring road, NICE road and other highways approaching the city from all sides showing that the HOV lanes, if implemented, will reduce the overall emissions by considerable amount [26].

It must be taken into account when analyzing the global transportation system [27]:

- Modes of transportation.
- The elements of the transportation system: the people and goods transported; vehicles that transport them; infrastructure network for the movement of vehicles, passengers and goods, including terminals and transshipment points.

- Movements through the transportation system, including passenger and freight traffic from all origins to all destinations.
- The total trip from origin to destination through all modes and means, for each specific trip [27]

The different modes of urban transport in Huánuco - Perú can be categorized by the type of service they provide or the volume of trips made [28], Depending on the type of service they provide:

- Private transportation: Operated by the owner of the unit on roads provided, operated and maintained by the state, such as: Cars, Motorcycle taxis, Vans, Bicycles [28].
- Rental Transportation: Used by a person who pays for a vehicle provided by an operator, driver or employee to accommodate the user's travel preferences. Request Response Services: Contract Services [28].
- Public transportation: A transportation system that operates with fixed routes and a predetermined schedule, and that any user can access in exchange for a predetermined price [28].
  - Which Bus rapid transit, also known as express bus or Cosac (high-capacity segregated corridor): It is defined as a bus-based mass transit system that combines the capacity and speed of train systems with the flexibility of buses. [29].
  - Microbus - Rural Public Transportation Van (Combi) - Coaster: Passengers choose to travel in this medium, because users prefer their routes that cover long distances and are very different from each other, in addition to the low cost of the service. On the other hand, this means is very unsafe and has low quality standards, since its drivers do not respect traffic rules and/or are not formal. [29]
  - Taxis: According to Ordinance No. 1684 of the MML, there are three taxis: (1) independent taxi, a service provided by natural persons; (2) taxi station, provided by legal entities, with a minimum fleet of 10 vehicles and a communications center; (3) Taxi Remisse, preferably aimed at tourists as it offers greater comfort, is provided by legal entities, with a minimum fleet of 10 vehicles and a communications center [29].
  - Private taxi: In general, the visual characteristics by which we identify them are yellow or white paint, a top taxi sign and a license plate number stamped on the sides. The benefits appreciated by users of this service are convenience, safety, arrival at the specific destination and time savings [30]
  - A motorcycle taxi is defined as a smaller vehicle consisting of a three-wheeled motorcycle and a small cab that is used as a means of transporting people for short distances [29]
  - Mototaxi: This means of transport is a small vehicle with a maximum capacity of 2 passengers, they have very short non-established routes and established stops. In addition, Lima has more than 600,000 motorcycle taxis in operation; however, 40% of these are informal [30]

Informal modes of transport are integrated into five classes depending on the capacities of the vehicles.:

These classes are buses (class I), minibuses and microbuses (class II and III), three-wheelers and motorcycles (class IV), and those non-motorized like bicitaxis (bicycle-taxis) or those drawn by animals (e.g., horses). In this sense, mototaxi is classified as a class IV vehicle. This classification must be carefully used since, in emerging countries, the bicitaxi and mototaxi modes (whose difference lies in human propulsion or combustion engine) both have opposite legal connotations [31].

Mototaxi emerged when bike taxi service providers changed bicycles to low-cost utility motorcycles and scooters with an engine with displacements ranging from 50 to 150 cc.

With this technology, physical effort and travel time were reduced in exchange for increased operational costs. This concept is also known as pedicab in the USA, Canada, most European countries, and Oceania; cycle rickshaw in South, Southeast, and East Asian countries; velotaxi in Germany; cyclo in Vietnam and Cambodia; beca in Malaysia; becak in Indonesia; trisikad in the Philippines; or trishaw in Singapore [31].

This study tries to propose a mass transportation system with the required changes, as well as the proposal of a road design focused on a BRT system within the limits of the urban area of Huánuco, which allows the organization and improvement in the quality offered. public transportation service.

### 3. Materials and Methods

For the design of the proposal for the urban vehicular flow transportation system in Huánuco, the process began with the generation of an Origin and Destination matrix derived from a travel preferences survey. This matrix was calibrated using vehicular capacity and visual occupancy capacity, inputted into the ArcGIS program based on the previously conducted transport zoning, wherein the data were analyzed, quantified, and the routes for the proposed Transport system were designed.

The research was structured into four stages: (1) Data collection on the public and private transportation road network, (2) Importation and creation of the transportation road network in the urban area of the Huánuco district, (3) Zoning and connectivity of the study area, (4) Creation of the public transportation O/D matrix, supported by digital tools (ArcGIS, AutoCAD, Excel).

In the processing of the collected data from the travel preferences survey, the statistical program Microsoft Excel was applied for execution and to conduct statistical analysis.

The unit of analysis corresponds to the Population of the metropolitan area of Huánuco, for which the population >6 years old was calculated, for the metropolitan area of Huánuco, which includes the urban area of Huánuco, which includes the Districts, Amarilis and Pillcomarca, so the population was calculated based on the data available from the INEI Geographic Information System in which there is information on the population as of 2007, the last national census, which was processed and projected the population >6 years old, to the year 2023, according to the growth rate which is 0.8%, having an analysis unit of 160,472 inhabitants), however we cannot analyze due to the cost that would be required, in addition to the fact that it is By conducting an investigation, a sample must be determined.

Vehicular and traffic occupancy evaluations were carried out along the Cortina line, intercept surveys conducted, all aimed at generating an Origin and Destination Matrix, along with its calibration.

#### 3.1. Curtain Line

The Cortina line is a fictional subdivision that follows natural or artificial boundaries where there are few crossings, such as a river or a railway line, central highway. These data were used to feed the Origin and Destination matrix.

The 9 identified bridges known as the Cortina line are shown in Table 1. These are located at natural boundaries and serve as infrastructure to connect roads between the districts of Huánuco, Amarilis, and Pillcomarca, all part of the Huánuco metropolitan area.

**Table 1.** Curtain Line Bridges.

Bridge Number	bridge name
Bridge 1	Bridge Huallaga

Bridge 2	Bridge Cayhuaynita
Bridge 3	Bridge Tingo
Bridge 4	Bridge San Sebastian
Bridge 5	Bridge Burgos
Bridge 6	Bridge Pavletich
Bridge 7	Bridge Joaquin Garay
Bridge 8	Bridge Daniel Alomia Robles
Bridge 9	Bridge Colpa Baja

In Figure 1, you can see the bridges positioned as a "curtain," distributed within the metropolitan area of Huánuco. These bridges serve as vehicular transfer points between the districts of Huánuco, Amarilis, and Pillcomarca.

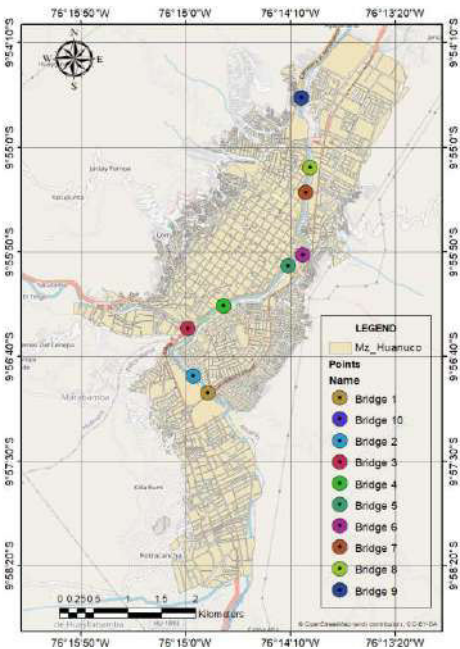


Figure 1. Location of Points, on a curtain line, in Huánuco, Perú in 2022.

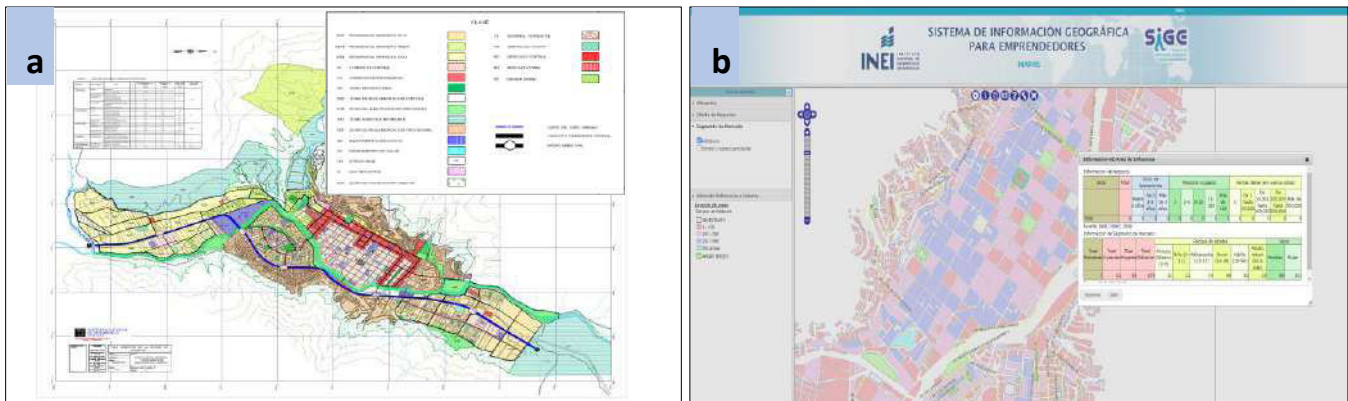
3.2. Intercept Surveys

The city of Huánuco is an elongated and dispersed mid-sized city, with a low population density, divided into 32 traffic zones.

Figure 2 displays the zoning of the urban area of Huánuco city, consisting of 32 traffic zones.

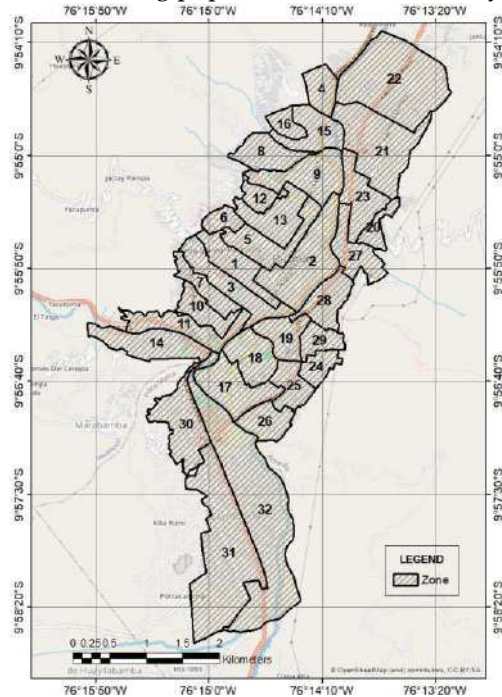
The population over 6 years old was estimated for the metropolitan area of Huánuco, encompassing the urban area of Huánuco, including the districts of Amarilis and Pillcomarca. Population estimates were based on available data from the Geographic Information System of the INEI for the year 2007. This data was processed and projected the population over 6 years old for the year 2023, considering a growth rate of 0.8%.

This zoning has been carried out based on the existing land uses (residential, commercial, agricultural, industrial) and the existing population density, according to INEI, which is detailed by block as can be seen in the following figure.



**Figure 2.** a) Map of population quantity by blocks; b) Land use map in the city of Huánuco, Perú in 2022.

The population was estimated by blocks in 2023, working with the population over 6 years old, delineated based on traffic zoning as shown in Figure 3. These zones were generated considering population size, land use types, and river locations.



**Figure 3.** Urban Zoning Map in the Huánuco district, Perú in 2022.

The Travel Preference Surveys were conducted in the traffic zones located within the metropolitan area of Huánuco, based on the calculated sample size.

The travel preference surveys were conducted by intercepting individuals residing in each study zone, aiming to gather detailed information about transportation modes, origins, and destinations of their trips, along with socio-economic data provided by residents of an urban area. This survey serves as input for creating the Origin-Destination matrix, in connection with the generated traffic zones and the population count in each, with 389 surveys distributed based on population density across traffic zones.

Following data collection, for processing purposes, the research relied on the support of programs such as EXCEL, MAP SOURCE, GOOGLE EARTH, and ARC GIS.

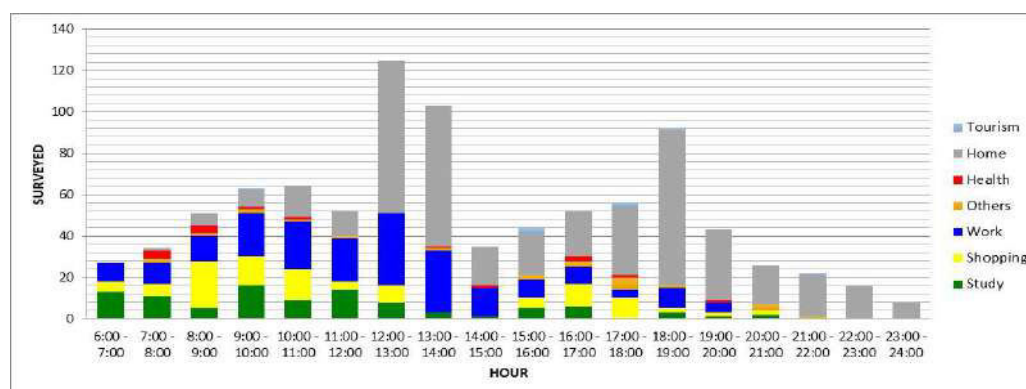
4. Results



# 4.1. Intercept Survey Results

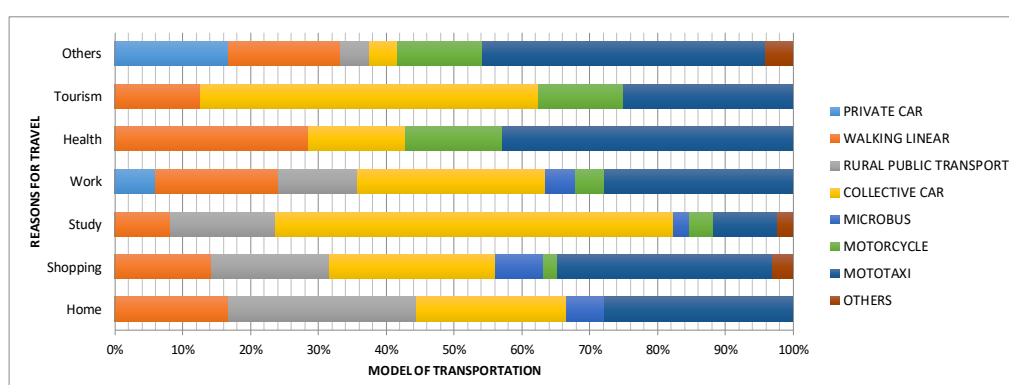
From surveys conducted with 384 people through intercepts across traffic zones, the following results were obtained:

Travel is concentrated during rush hours in the city of Huánuco between 12:00-13:00 hours. This is because people return home for lunch, as observed in Figure 4. Trips during this time are short, The mode of transportation used during the rush hour is the collective car, followed by Rural Public Transportation Van, Mototaxi, and walking.



**Figure 4.** Time distribution according to the reason for travel, in Huánuco, Perú in 2022.

According to reasons for travel, among those who have more incidents at home, a higher percentage travels using the Rural Public Transportation Van (Combi), followed by Microbuses and Buses. For work-related purposes, they travel using Microbuses, followed by collective cars and walking. In terms of studies, they predominantly use collective cars, followed by Combis, Microbuses, and walking. For shopping purposes, they primarily use Mototaxis, followed by Buses, vans, and walking, as depicted in Figure 5.



**Figure 5.** Reason for travel according to mode of transportation used, in Huánuco, Perú in 2022.

As modes of transportation according to travel purposes, in the case of the collective car, which represents the highest number of trips, users travel for Study purposes, followed by Work and Shopping. The Rural Public Transportation Van transports users primarily for Shopping, followed by Work and Study. Mototaxis mainly transport users for Work and Shopping reasons. For walking, users travel mainly for Work purposes, followed by Shopping and Study

The figure 6, shows that the average travel rate in the metropolitan area of Huánuco, the most expensive is the private car with 20 soles, followed by linear motorcycles that have an average cost of S/. 4.00, and the Mototaxis that are used most frequently is S/. 3, buses have an average cost of S/. 2, the Microbus has an average cost of S/. 1, and the Rural Public Transportation Van (Combi) have an average cost of S/. 1; of which the mode of transport with the longest travel time is the minibuss, with

a 30-minute trip, followed by a private car, with a travel time of 27.7 min, buses have a travel time of 25.5 min, linear motorcycles with 18.9 min, minibuses with 17.5 min, Mototaxis with 15.5 min, walking have an average travel time of 16.6 min

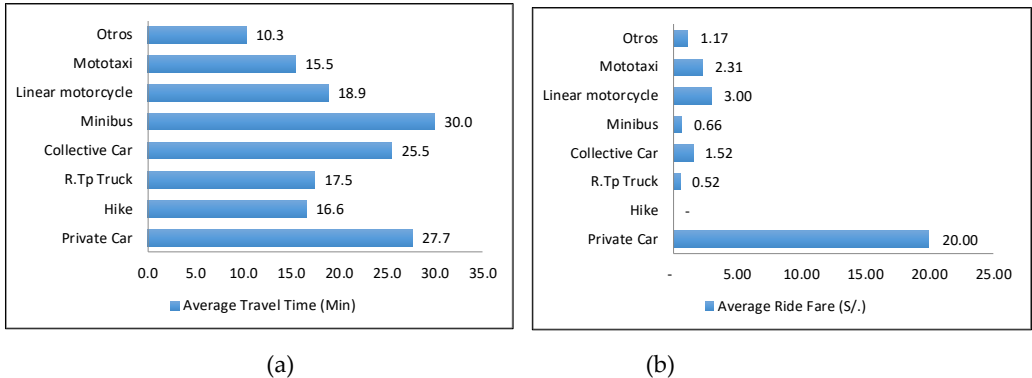


Figure 6. a) Average Travel Time; b) Average Ride Fare, in Huánuco, Perú in 2022.

From the processing of data from surveys linked to transit areas with the objective of identifying the origins and destinations of the trips, as well as the population expansion and socioeconomic data from the Institute of Statistics and Informatics of Perú, the origin-destination matrix was generated. which was calibrated with the vehicle and occupancy capacities. This matrix was used to draw lines of travel desire in order to identify people's movements and propose mass transportation routes based on these.

Figure 7 displays desire lines for total trips, where in the city of Huánuco, the highest incidence of trips is represented in zone 2, located in the main square, followed by zones 3 and 1, where the Huánuco Market is situated. In the Amaryllis district, trips concentrate in zone 19, home to Essalud, followed by zone 18 where the Amaryllis Market is located. In the Pillcomarca district, there isn't a significant concentration as there are no commercial zones, only the Hermilio Valdizán National University, representing a small number of trips situated in zone 3.

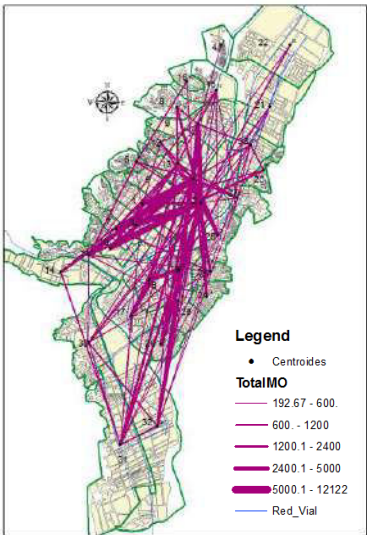
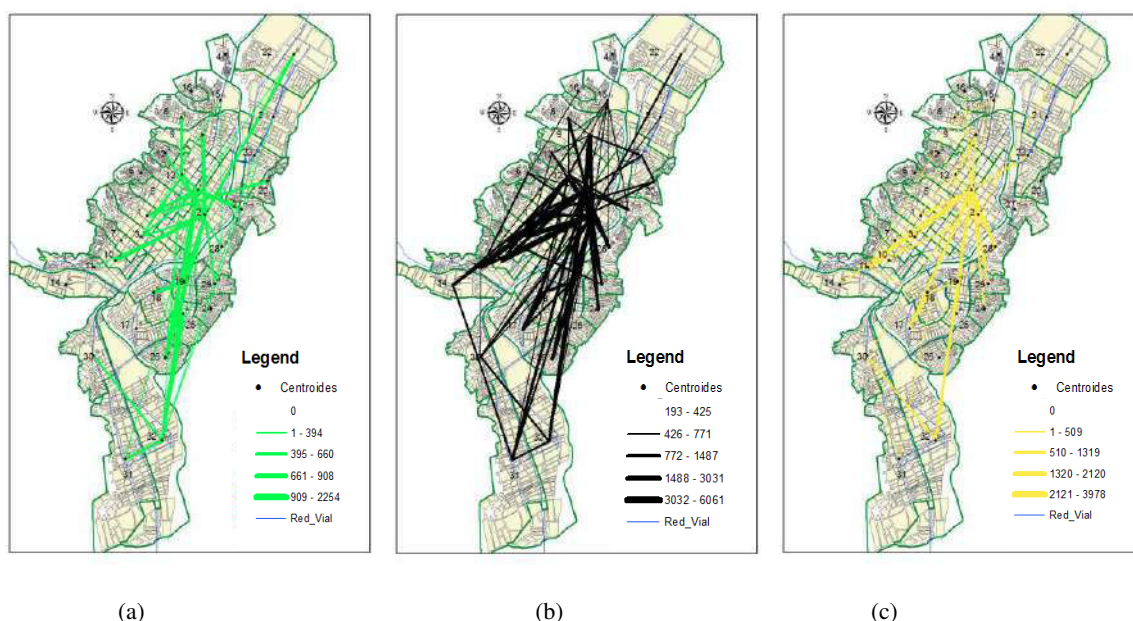


Figure 7. Total Travel Wish Lines, in Huánuco, Perú in 2022.

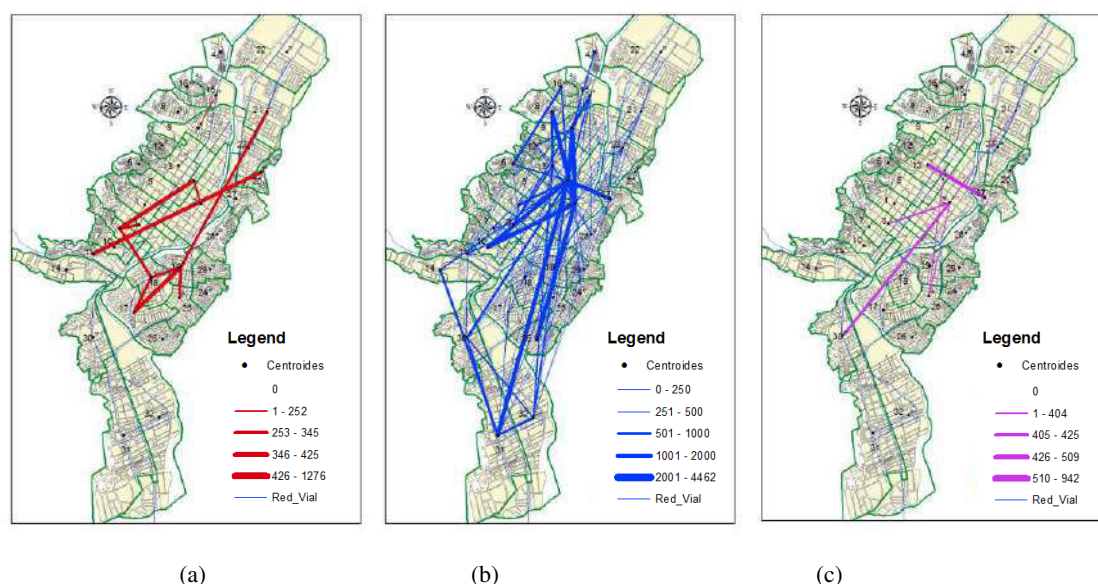
In Figure 8, you can observe desire line maps for trips related to study, home, and shopping purposes, obtained from the intercept surveys conducted in the metropolitan area of Huánuco. From these, it can be identified that there are study concentration areas along roads in zone 30, where the Hermilio Valdizán National University is located, and

in zone 2, where the University of Huánuco is situated. This zone also concentrates emblematic schools of Huánuco. Regarding the home-related trips map, it appears scattered, but the highest concentration is found in zones 2, 7, 10, 17, 18, 19, 3, 31, 32, the areas with higher population density. For shopping-related trips, the concentration is in zones 2, 5, 12, 9, 13, 8, where the commercial centers and markets of Huánuco are located.



**Figure 8.** (a) lines of travel desires for reasons of study, (b) lines of travel desires for reasons of going home, (c) lines of travel desires for reasons of shopping, in Huánuco, Perú in 2022.

In Figure 9, you can see the maps of travel desire lines for reasons of health, work, tourism, obtained from the intercept surveys carried out in the metropolitan area of Huanuco, from which it can be identified that, for health reasons, They have trips in zone 2 where the regional hospital is located, zone 10 where the metropolitan is located, zone 18, 19 where the Essalud and located the C.S. Showing, zone 21 where Peru Korea is located; From the map for work reasons, it can be seen that there is a concentration in zone 2 and surrounding areas in the center of Huánuco, where the headquarters of the different institutions are located; On the travel map for tourism reasons, it is observed that trips are made to zone 2 where the main square, the main and oldest churches are located.

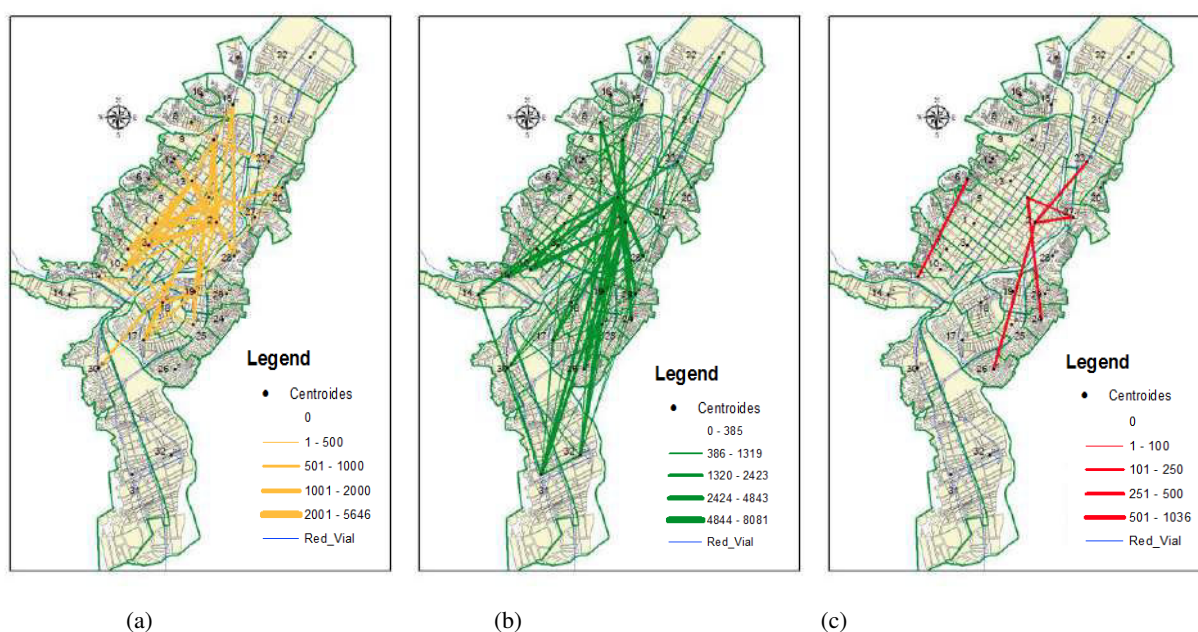




**Figure 9.** (a) lines of travel desires for health reasons, (b) lines of travel desires for reasons of going to work, (c) lines of travel desires for tourism reasons, in Huánuco, Perú in 2022.

Desire line maps for travel modes—walking mode, motorcycle mode—obtained from intercept surveys conducted in the metropolitan area of Huánuco. From these, it can be identified that pedestrians predominantly travel through the center of Huánuco with Walking mode, covering short distances. In the linear map for motorcycle trips, it is evident that most trips are towards areas with considerable distances, primarily concentrating in the center of Huánuco.

In Figure 10, you can observe desire line maps for travel modes—Mototaxi mode, Public Transportation, Private Car—obtained from intercept surveys conducted in the metropolitan area of Huánuco. From these, it can be identified that users travel medium distances using Mototaxis, with fares ranging between S/3.00 to S/4.00, primarily between Huánuco and Amarilis. In the Public Transportation mode, there's a higher preference, as trips are observed from Huánuco to Amarilis and Pillcomarca. This is due to fares fluctuating between S/1.00 and S/1.50. In each private car, very few users are traveling to the center of Huánuco in zone 2, where public and private establishments (banks, Judicial Power, hospital) are located.



**Figure 10.** (a) lines of travel desires with Mototaxi mode, (b) lines of travel desires with Public Transportation mode, (c) lines of travel desires with private car mode, in Huánuco, Perú in 2022.

~~In Figure 14, you can observe desire line maps for travel modes—Collective Car mode, Rural Public Transportation Van (Combi), Microbus—obtained from intercept surveys conducted in the metropolitan area of Huánuco. From these, it can be identified that~~  
 The Collective Car mode, the majority of travels occur between districts, mainly from Huánuco to Amarilis and Pillcomarca, with a fare of S/2.00. In the Rural Public Transportation mode using a van (Combi), most trips are from Huánuco to Las Moras and Pillcomarca, with ticket costs ranging between S/1.00 and S/1.50. In the Microbus mode, trips are observed from Huánuco to Amarilis, covering that route until reaching Yanag.

## 4.2. Results of vehicle capacity and visual occupancy

### 4.2.1. Vehicle capacity:

From the vehicular capacity analysis, it's been determined that the peak hour in the Huánuco district is from 12:15 to 13:15 with 16,997 mixed vehicles.

In Figure 11, you can observe the fluctuation in vehicular flow in Huánuco, identifying that we have a peak hour at noon. This is due to Huánuco residents returning home for lunch. The peak hour is also noticeable in the time interval 12:15-1:15 p.m.

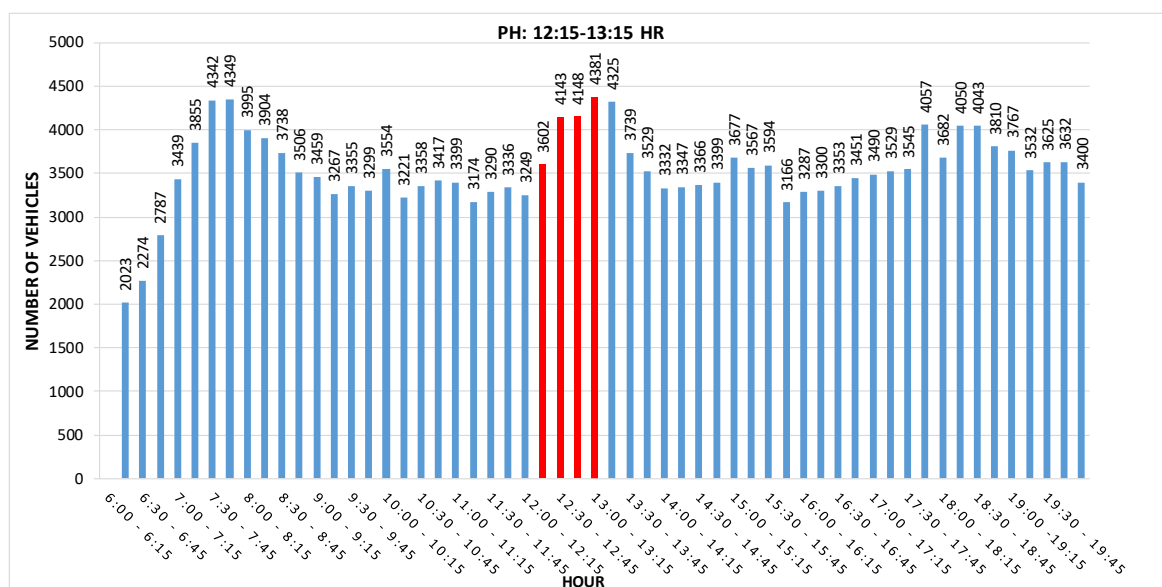


Figure 11. Rush Hour Histogram, in Huánuco, Perú in 2022

The number of vehicles passing per direction during rush hour in the Huánuco district can be observed in the following figure, indicating that the predominant movement in Huánuco is mostly in the West-East direction with 5885 mixed vehicles, and the East-West direction with 5610 vehicles:

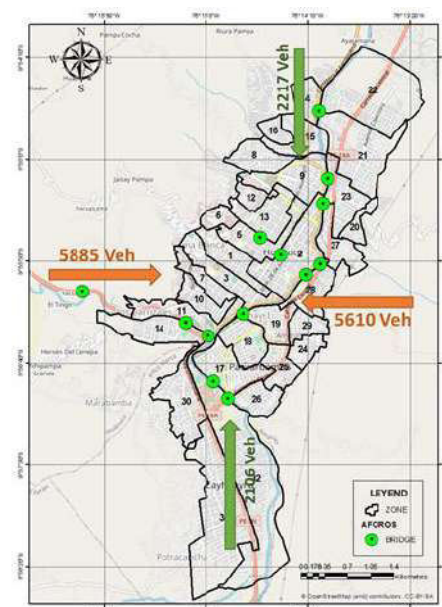


Figure 12. Movement of mixed vehicles in each direction during rush hour in the district of Huánuco, Perú in 2022

In order to identify the levels of congestion in places with the highest concentration of trips, a modeling of the current state of the operation of the roads was carried out, which is shown below.

Intersection of Jr General Prado with Leoncio Prado.

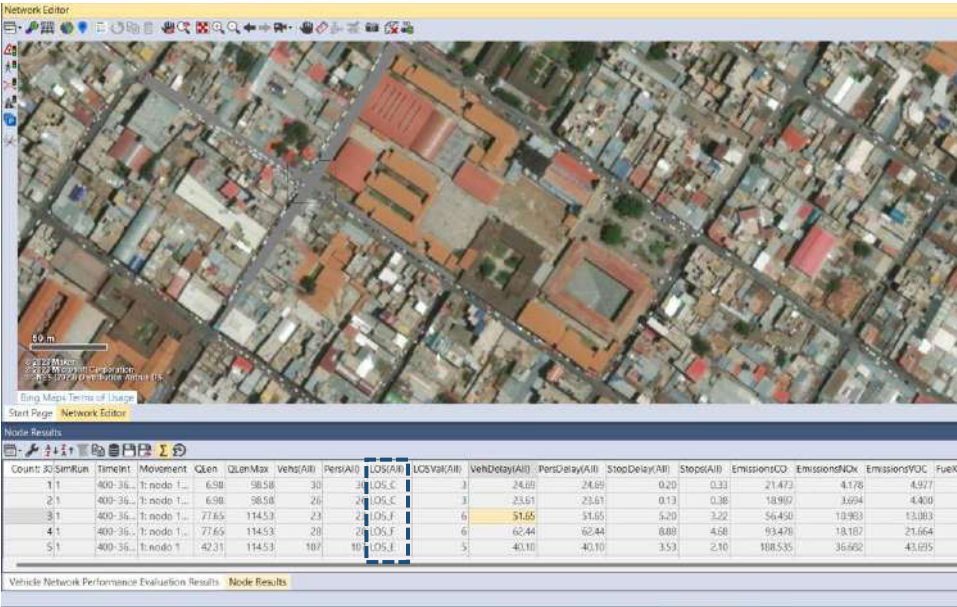


Figure 13. Traffic modeling in the Intersection of Jr General Prado with Leoncio Prado.

The modeling results, as visualized in Figure 13, indicate that the intersection has a service road E at rush hour, which describes a saturated intersection, generating lost travel times, as well as environmental pollution [19], this intersection is located around the Huánuco Model Market.

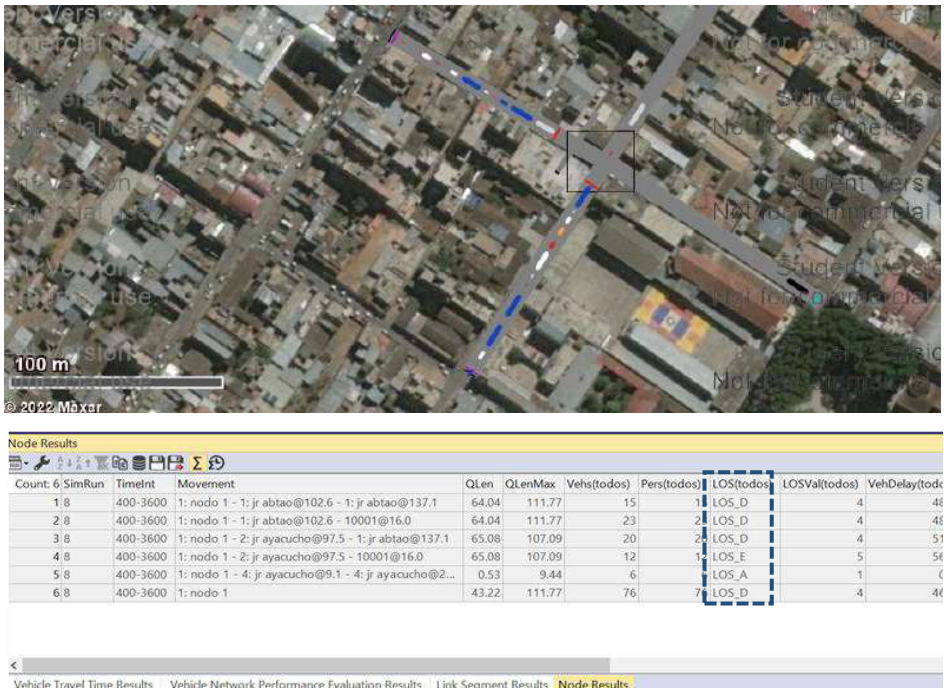


Figure 14. Traffic modeling in the Intersection of Jr Ayacucho with Abtao.



The modeling results, as visualized in Figure 14, show that the intersection has a service level D at rush hour, which describes a saturated intersection, generating lost travel times, as well as environmental pollution. as contrasted by what was said by Pacheco Chavez et al [19]; This intersection is located around the Mercado Modelo and main shopping centers of the city of Huánuco.

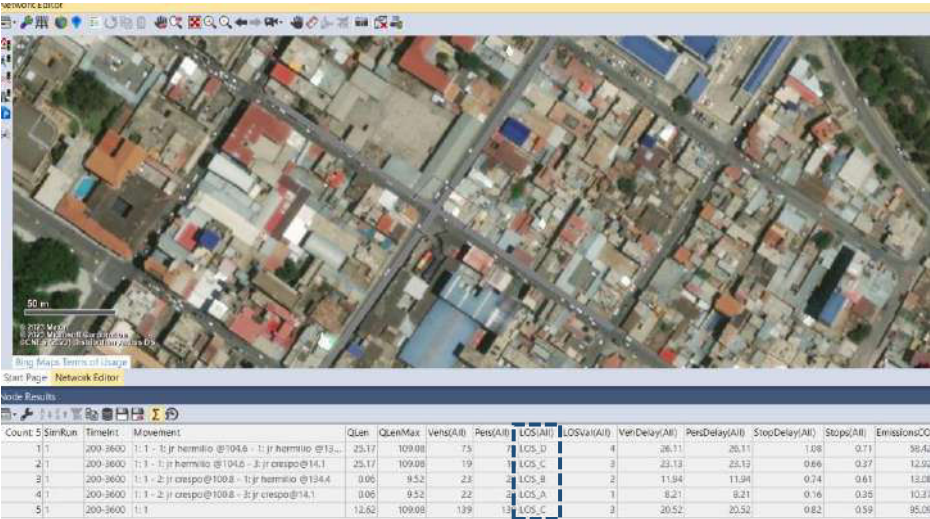


Figure 15. Traffic modeling in the Intersection of Jr Crespo Castillo with Hermilio Valdizan.

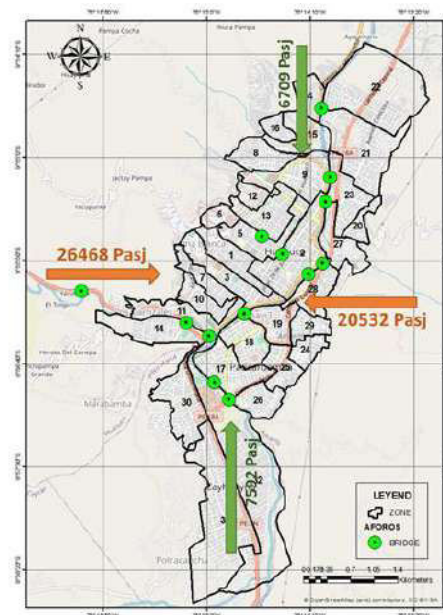
The modeling results, as visualized in Figure 15, show that the intersection has a service level D at rush hour, which describes a saturated intersection, generating lost travel times, as well as environmental pollution [19]; This intersection is parallel to the main square, however it does not have as much traffic of vehicles and pedestrians as in the Market, which contrasts with the result.

Is displayed that in the two intersections located in transit zone 2, where the Market is located and adjacent to the main square, there is a level of service E and D that demonstrate that the roads have been exceeded in their capacity, in the Jiron Crespo Castillo with Valdizán, which is a block that is located 1 block from the main square but not in the center of the shops and financial institutions such as commercial ones, the level of service is C in the node that indicates us that is reaching the capacity limit on this road.

4.2.2. Visual occupation:

From the visual occupancy capacity results during rush hour, the following data was obtained:

During peak hours, the passengers traveling with the existing vehicles in the Huánuco district are shown in the following figure, with the highest incidence being 26,468 passengers in the West-East direction and 20,532 passengers in the East-West direction, as seen in the following figure.



**Figure 16.** Passenger movement by direction during rush hour in the Huánuco district. Source: Verastegui Yessica, Verastegui Gaby and Esenarro Doris (2022)

Table 2 displays the number of passengers transported by mode of transportation during peak hours. It indicates that the vehicle type transporting the highest number of passengers is the minibus with 18,826 passengers, followed by the mototaxi with 15,683 passengers, collective car with 9,577 passengers, and linear motorcycle with 5,914 passengers.

**Table 2.** Distribution of passengers by type of vehicle by direction in the district of Huánuco.

Vehicle Type	South North	North South	West East	East West	Total
Private Car	845	508	3016	1245	5614
Collective Car	1227	837	3353	4160	9577
Mototaxi	2568	2290	6386	4439	15683
R.Tp Truck	1492	1814	140	1258	4704
Van R. Miniban	21	100	515	236	872
R.T Truck	9	20	2	35	66
Minibus	0	261	11175	7390	18826
Interprovincial Bus	0	30	0	15	45
Linear motorcycle	1430	849	1881	1754	5914

Analyzing the desire lines of travel according to different modes and reasons, as well as the results of vehicular capacity and visual occupation, we can identify that the population of Huánuco predominantly moves towards the city center located in transit areas 1, 2, 3, 5, focusing on these areas of commerce, public entities, and private establishments of the city. Similarly, in the Pillcomarca district, there is mobility towards the National Hermilio Valdizan University located in zone 32. In the Amaryllis district, mobility concentrates in zones 18 and 19, where insurance and the market are situated. Considering the existing road infrastructure, available space, and the street layout in Huánuco, the following proposal is generated.

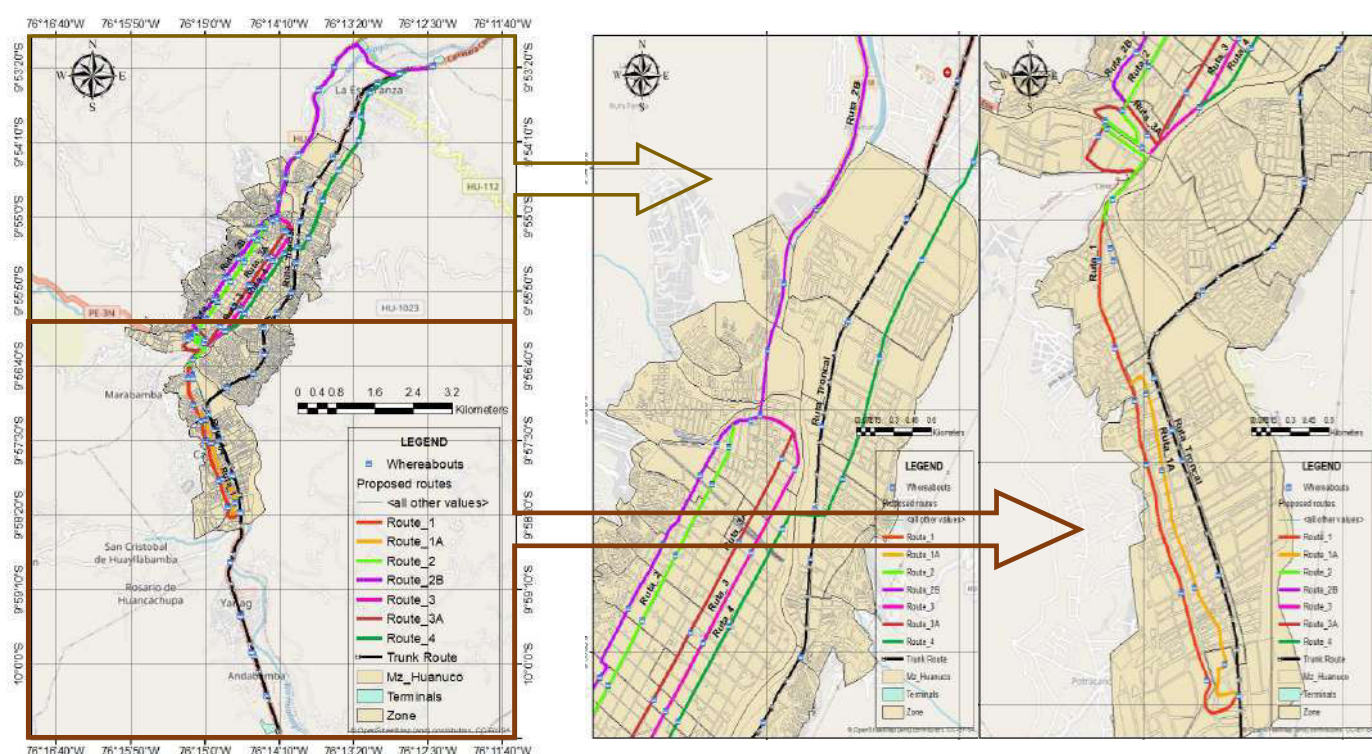
We propose 8 routes, comprising 7 feeder routes and 1 trunk route, each with specific passenger demand per route determined based on passenger demand derived from travel preferences and surveys of vehicular capacity, as depicted in Figure 20.

### 4.3. Proposal

~~As mentioned by Kathryn Robson et al. (2019, pp7),~~ Mass transit systems like those in Paris, London, and Seoul offer examples of efficient and reliable public transportation as models for Australian cities. The reality is that while public transport in the established inner areas of Sydney and Melbourne has seen some success in planning, the outer urban settlements of both cities continue to grow and require effective planning and implementation of public transportation [32], [33], [34], [35].

~~As Aqsa et al. mention in 2019,~~ Distances impact people's accessibility to public transportation. People take longer to reach their destination, so it's necessary to expand public transport routes to these areas to increase accessibility and reduce the use of private vehicles. Proposing the implementation of the proposed BRT system and public transportation infrastructure [5].

From the service levels on the roads, identified in the modeling of the intersections, they indicate that in the historic center, where businesses, public institutions and the Market are concentrated, they have exceeded the capacity of the road, which is why it is necessary generate solutions to the problems that contribute to reaching that level of service so that transport users have access to public transport with adequate service conditions.



**Figure 17.** The figure shows the proposed solution for the transportation system in the city of Huánuco, with 8 routes, one of which is a trunk line and the remaining 7 are feeder routes.

According to results obtained from interception surveys, as well as vehicle capacity, it is identified that the population moves in the longitudinal North-South direction with an average length of 12.5 km in the urban area, as well as the form of urban expansion as well. It is adapted longitudinally, for which longitudinal routes are proposed that run through the 3 districts that make up the urban area (Huánuco, Amarilis, Pillcomarca), the location of loading and unloading of passengers is also taken into account, and the lines of desire are also identified. of total trips in figure 7, that the concentration of trips occurs

in its greatest proportion in zone 2 where the main square is located, there are commercial areas, the location of public and private institutions such as banks, the municipality, commercial stores, boutiques, among others, for which routes are proposed distributed in the 3 districts of the urban area, identifying in turn the generations of existing trips.

The present research proposes 7 feeder routes and one trunk route for the implementation and operation of the routes. For the feeder routes, the exclusive use of lanes for rapid mass transit buses is recommended, aiming to reduce travel times for system users while offering a high-quality transportation system with appropriate infrastructure and a fleet of modern buses.

Table 3 indicates the number of buses required and the frequencies for the routes in the West-East direction, which has been calculated according to the existing travel demand for a 20-year projection, in addition, retention buses are included for mechanical contingencies of the vehicles:

**Table 3.** Fleet required direction West-East

Sense	Route	Fleet Required in 10 Years	Buses Retain
West East	Orange	78	2.00
	Green	87	2.00
	Aquamarine	34	2.00
	Dwelling	78	2.00
	Pink	33	2.00
	Trunk	47	2.00
	CHERRY	36	2.00

In the West-East direction, 394 buses are required to meet the existing transportation demand.

Table 4 indicates the number of buses required and the frequencies for routes in the East-West direction, which has been calculated according to the existing travel demand for a 20-year projection, in addition, retention buses are included for mechanical contingencies of the vehicles:

**Table 4.** Strong fleet in the East-West direction.

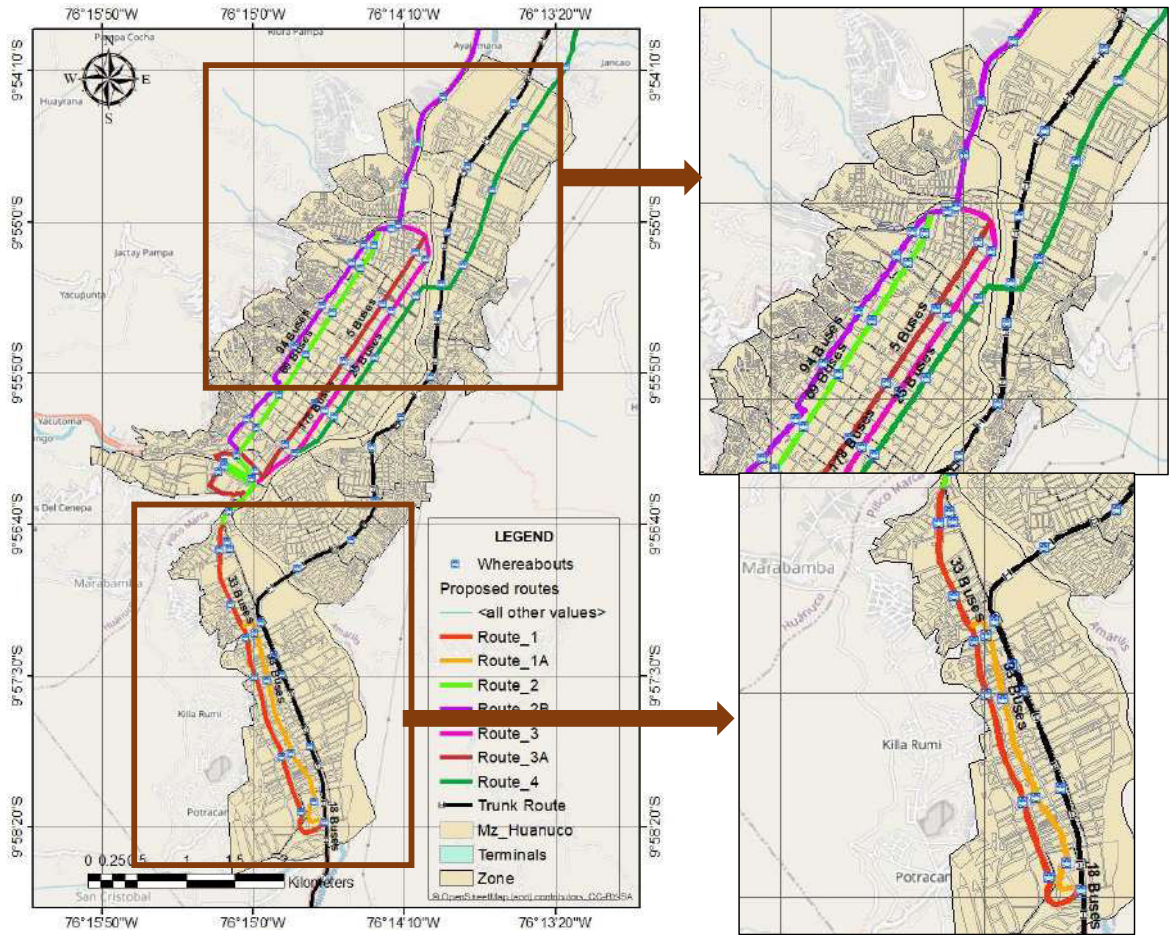
Sense	Route	Fleet Required in 10 Years	Buses retain
West East	Orange	33	2.00
	Green	25	2.00
	Aquamarine	69	2.00



dwelling	94	2.00
Pink	178	2.00
Trunk	18	2.00
Cherry	5	1.00

In the East-West direction, 422 buses are required to meet the existing transportation demand.

Figure 18 shows the number of buses required for the operation of the proposed routes.



**Figure 18.** The figure shows the number of buses required in the city of Huánuco, Perú in 2022 according to proposed routes.

The required buses have been identified as follows:  
Trunk and Feeder Route: Buses with a capacity of 80 passengers.  
Bus characteristics:

- Length: 12m.
- Capacity: 80 passengers.



- Speed: 20 km/h.

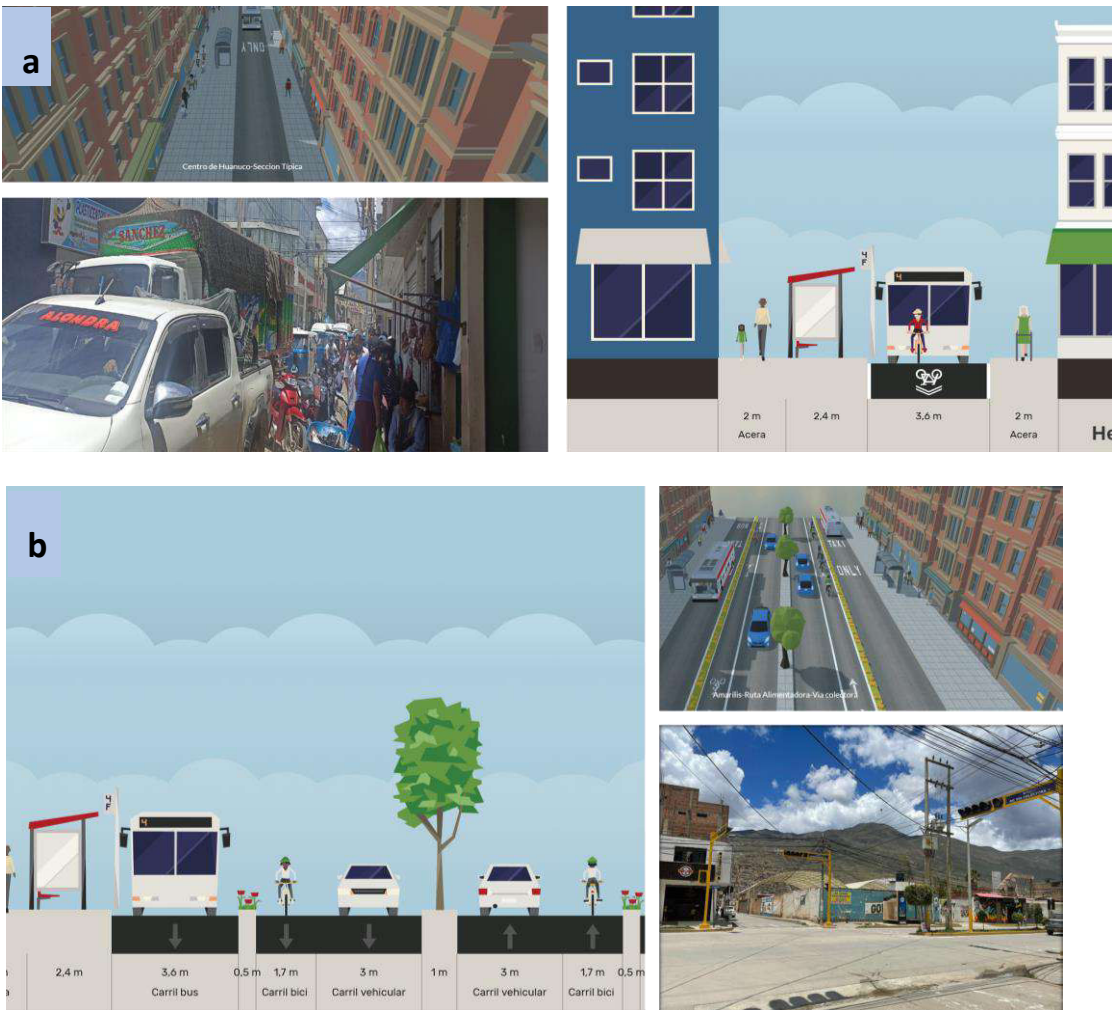
With the implementation of the routes, it is also recommended that motorcycle taxis and collective cars can serve as feeders to the proposed transportation system, in areas where they do not cross the proposed routes, thus achieving the ordering of the transportation system.

#### 4.4. Road infrastructure

7 feeder routes and 1 main route are proposed, covering the districts of Huánuco, Amaryllis, and Pillco Marca. The proposed routes should have the necessary infrastructure, which can be observed in detail in the cross-sections. Figures 22 and 23 are visible, forming an integrated transport system. This proposal aims to optimize travel times, provide quality infrastructure, and reduce pollution caused by existing vehicle congestion, including the implementation of a modern vehicle fleet.

The proposal includes the creation of totem-style bus stops and the installation of horizontal and vertical signals, currently lacking in the districts of Amaryllis and Pillcomarca. The considered roads must be equipped with proper road infrastructure, including paving and suitable traffic conditions.

An integrated traffic light network should be established, or alternatively, the synchronization of functioning traffic lights in the metropolitan area of Huánuco should be checked, as this will help improve vehicle flow.





**Figure 19.** (a) Before and after the typical section proposed on the routes of the Urban Center of Huánuco, (b) Before and after the Typical segment proposed in the routes of the district of Amarilis, on the collector road, (c) Before and after the Typical segment proposed in the Main Route of the district of Amarilis, on the central road, and (d) shows the Before and after the typical segment proposed in the Main Route of the district of Pillco Marca, on the central road, in Huánuco, Perú in 2022.

## 5. Discussion

~~As Mendoza and García argue in 2013,~~ The mass transit system in various countries worldwide, such as Curitiba, is considered an innovation focused on the economic and social development of the metropolitan region. It maintains a network spanning 790 km, catering to approximately 75% of the population in the Metropolitan Area of Curitiba. Its structure is based on exclusive lanes in each corridor, forming a 'trinary' system: three parallel lanes and two rows of interspersed blocks. This system is globally known and recognized for being pragmatic, integrated, efficient, and profitable. Additionally, its usage benefits the environment by reducing car usage, as previously mentioned [34]. This contrasts with the results of the present research.

The BRT systems is a public transport system that reflects the requirements above-mentioned. It has developed mainly in South America, where it was implemented for the first time. Taking into account the positive implications, it has spread globally, especially in Europe, BRT can be an upgrading solution for existing bus line systems that allow contexts with limited economic means to guarantee high-efficiency services, with significant positive implications both in economic and livability terms [36]

From the results of interception surveys, vehicle capacity, and visual occupancy, it has been identified that in Huánuco, 29% of the population travels by Collective Taxi, followed by 25% using Mototaxis, 17% using rural public transportation vans, and 4% using minibusses. Regarding the return home, 49% use these transportation means, followed by 23% for work, 12% for shopping, and 10% for study. Concerning the return home, it has been identified that for the collective taxi, representing the highest number of trips, users travel for study, followed by work and shopping. The rural public transportation van moves users primarily for shopping, followed by work and study. Mototaxis predominantly transport users for work and shopping. For walking, users travel mainly for work, followed by shopping and study.

Regarding rush hour, the vehicle capacity throughout the urban area of Huánuco has been identified to peak from 12:15 to 13:15, with 16,997 mixed vehicles circulating, representing 11.67% of traveling vehicles in the district on day.

There is a 29% demand for passengers in collective vehicles; however, within the vehicle fleet, this represents 18% of the available supply, leading to inefficient service, displacing 16% of passengers. Similarly, there is a 25% demand for passengers in mototaxis; however, within the vehicle fleet, this represents 38%, indicating it as the most abundant transportation mode, causing the highest percentage of traffic congestion, currently displacing 25% of passengers. For public transportation in minibuses and rural public transportation vans (combi), there is a 21% demand for passengers; however, within the vehicle fleet, this represents 12%. However, this mode of transportation displaces 39% of passengers. This suggests that users of the transportation system prefer to use these economical modes, although there are enough units and the necessary number of routes. Currently, Microbuses and Rural Public Transportation Van (Combi) in Huánuco transport the population from Huánuco to Amaryllis and Pillcomarca but do not meet the existing demand, which also contributes to the generation of environmental pollution in the world ~~as mentioned. Muñoz Soccrates et. al~~ [2]

The city of Huánuco currently lacks an efficient transportation system and quality infrastructure due to poor transportation service offerings, vehicular congestion in the city, inadequate road infrastructure, resulting in environmental and noise pollution. This research focuses on providing solutions to the identified deficiencies.

To cater to the demand from South to North of 135,343 passengers, the creation of 1 main route and 7 feeder routes is proposed, requiring 422 buses, suggesting totem-style stops, road infrastructure as observed in Figures 31 to 34, and exclusive lanes for the operation of this Mass Transit System. Similarly, to cater to the demand from North to South of 118,958 passengers, the proposal includes the creation of 1 main route and 7 feeder routes, requiring 394 buses, suggesting totem-style stops, road infrastructure as seen in Figures 31 to 34, including exclusive lanes for the operation of this Mass Transit System.

With the implementation of the proposal, it is also recommended to include motorcycle taxis and collective cars as feeders to the System, as well as the restructuring of existing transport routes so as not to interfere with the proposal, as well as the supervision and regulation of the Transport System, with which we will be able to order the Transport System and as Vilma Tapia et al maintain, Vehicular rearrangement can contribute to the continued reduction of various environmental pollutants [37].

Discouraging private transportation use and promoting the use of efficient public transportation will improve traffic conditions, alleviate vehicular congestion, thereby contributing to the success of this proposal, as mentioned by Kathryn Robson [38], ~~as also maintained by Vajjarapu Harsha et al. her research the study states that the fare restructuring of BMTC bus service and introducing BRT lanes will be helpful in decongesting the roads in Bengaluru as well as in reducing the vehicular emission. The modelling shows the positive effect of restructuring the BMTC fares as it is increasing the mode share of the buses by more than 2% and also increasing the revenue by more than 15%. From emission plots the fare restructuring would actually reduce the total Vehicle Kilometers Travelled (VKT) by all modes combined and will help reducing the emission of NOx, CO, CO2, PM, HC into the atmosphere [26].~~

In Lima, the implementation of an integrated system has improved the city's mobility, as well as the renovation of urban public spaces, with similar results obtained in Bogotá and Curitiba, ~~as stated by María Parra~~ [39].

## 6. Conclusions

- From the results of the interception surveys, it is concluded that 59% of the population in Huánuco travel by car, rural public transportation vans, minivans, and minibuses. However, these modes of transportation represent only 30% of the vehicles in the vehicle fleet, not meeting the existing demand.



• The levels of congestion in the district of Huánuco are high, reaching level E, which is not only due to the number of vehicles but also to the lack of regulation of the System, and the lack of inspection, as well as the poor condition of the existing road infrastructure.

• In the city of Huánuco, the quality of the road infrastructure offered is poor, there is no bus stop infrastructure, the existing authorizations for collective cars, minibuses have terminals within the roads, in the urban area of Huánuco, specifically around the market, where there is great congestion, these must be relocated and have their terminals off the roads, a restructuring of the existing transport routes is necessary and an evaluation of the authorized stops as terminals in the center of Huánuco that operate by invading and reducing the existing road width.

• From the results of the interception surveys, it is concluded that 25% of the population in Huánuco travels by mototaxis, representing the existing demand. However, within the vehicle fleet, mototaxis account for 38%.

• From the results of visual occupancy capacity, it is concluded that there is currently a demand for 135,343 passengers in the South-North direction, of which only 34,060 users are being absorbed. In the North-South direction, there is a demand for 118,958 passengers, of which 27,241 users are absorbed.

• From the vehicle capacity results, it is concluded that the peak hour is from 12:15 to 13:15, with 16,997 mixed vehicles circulating, representing 11.67% of the vehicles in the district.

• It is concluded that to provide adequate urban transportation services in the city of Huánuco, capable of meeting passenger demand, the implementation of a mass transit system is proposed. This implies adequate road infrastructure and its regulation. This system includes a Main Route and 7 feeder routes, which must be exclusively used within this system.

• With the implementation of the Urban Mass Transit system, 59% of the passengers, who prefer to use public transportation, will be absorbed, providing an efficient and quality transportation system.

• It is concluded that to absorb the demand of 135,343 passengers in the South-North direction, 422 buses are required.

• It is concluded that to absorb the demand of 118,958 passengers in the North-South direction, 394 buses are required.

It is concluded that by implementing the proposed mass transit system in this research, the existing demand for public transportation will be met, travel times will be reduced, and the effects of environmental and acoustic pollution caused by vehicular congestion will be mitigated. ~~This is supported by Zamora et al., 2013, where~~ The Transmilenio in Bogotá was a proposal aimed at improving urban mobility in the city and maintaining high occupancy. Since its operation began, it has shown significant benefits and potential; travel duration rates have decreased, as well as gas pollution and traffic accident rates [33], **Implementing a Bus Rapid Transit (BRT), have impacts include landuse and environmental changes, capitalisation of land value, and mobility improvements, the results suggest an overall positive perception of change in the urban environment after the Transmetro implementation; however, individuals without access to the BRT have an even more positive perception of its impacts than individuals inside the influence area [40]**

## References

1. Aleksandrovna Chebotareva, Anna. Evgenevich Chebotarev Vladimir and Ivanovna Danilina, Elena, Mechanism of the Administrative and Legal Regulation of Public Transportation System. [https://iaeme.com/MasterAdmin/Journal\\_uploads/IJCIET/VOLUME\\_9\\_ISSUE\\_13/IJCIET\\_09\\_13\\_015.pdf](https://iaeme.com/MasterAdmin/Journal_uploads/IJCIET/VOLUME_9_ISSUE_13/IJCIET_09_13_015.pdf). 2018, pp 7.

2. Muñoz Pérez, Z.; Sócrates; Salcedo Reátegui, José; Sotomayor Mendoza, Arturo. Contaminación ambiental producida por el tránsito vehicular y sus efectos en la salud humana: revisión de literature. ISSN: 1909-2520, <http://portal.amelica.org/ameli/journal/671/6713690008/6713690008.pdf>. 2021. pp 10, 6.
3. Konečný Vladimír, Gnap Jozef. Settey Tomáš, Petro František, Skrúcaný Tomáš and Figlus Tomasz. Environmental Sustainability of the Vehicle Fleet Change in Public City Transport of Selected City in Central Europe 13(3869), <https://doi.org/10.3390/en13153869>. 2020. 2020.pp 2,3.
4. Ochoa Covarrubias Gabriela, Luis Grindlay Alejandro, and Lizarraga Carmen. Does the Mass Public Transport System Cover the Social Transport Needs? Targeting SDG 11.2 in Guadalajara, Mexico. <https://doi.org/10.3390/app11167709>. 2021. pp 1.
5. Aqsa Jawed. M. A. H. Talpur. I. A. Chandio. P. N. Mahesar, Impacts of In-Accessible and Poor Public Transportation System on Urban Environment: Evidence from Hyderabad, Pakistan, DOI: 10.48084/etasr.2482. 2019. pp 1, 2, 4
6. Vencataya, Lomendra. Pudaruth, Sharmila. Dirpal, Ganess. Narain, Vandisha, Assessing the Causes & Impacts of Traffic Congestion on the Society, Economy and individual: a case of Mauritius as an emerging economy. <http://eccsf.ulbsibiu.ro/RePEc/blg/journal/13315vencataya.pdf>. 2018. pp 2.
7. Afrin, Tanzina. and Yodo, Nita, A Survey of Road Traffic Congestion Measures towards a Sustainable and Resilient Transportation System. doi:10.3390/su12114660. 2020. pp 12.
8. Rajib Banik, Dilip Goswami and Islam, Shafiqul, Empirical Analysis to Explore the Deficiencies in Public Transport System: a case study on Gazipur. ISBN-978-984-34-3502-6. 2018. pp 4.
9. Muzamil Hussain, Shah1. Irfan Ahmed, Memon. Aftab, Hussain Talpur. Waqar Ahmed, Sethar, Gopal Das. Factors Influencing Private Transport Users to Shift Towards Public Transport In Karachihi. 9(11). ISSN (e) 2520-7393. 2021. pp2.
10. Gierszewskia, Marek. Koźlak, Aleksandra, The impact of Congestion on the Costs of Public Transport in Starogard Gdański. 84(2019), <https://doi.org/10.26881/etil.2019.84.01>. 2019. pp 2.
11. Rivera Rosales Elsa Edith, Torres Ramírez Roberto Constancio, Gómez Rodríguez Iván Alexander, Rodríguez García Carlos Eduardo, Londoño Millán Noelia, Fraga Almanza José Luis, Zaldívar Rojas José David, Problemática del transporte público en la ciudad de Saltillo, Coahuila, [https://doi.org/10.37811/cl\\_rcm.v5i6.1122](https://doi.org/10.37811/cl_rcm.v5i6.1122). 2021. pp 2.
12. Transport for London, 2018, <http://tfl.gov.uk>, accessed 10th April, 2018, pp 7.
13. Li, G., Lai, W., Sui, X., Li, X., Qu, X., Zhang, T., & Li, Y, Influence of traffic congestion driving. Accident Analysis & Prevention, 141,105508, <https://doi.org/10.1016/j.aap.2020.105508>. 2020.
14. Olayode, I. O., Tartibu, L.K., Okwu, M.O., & Uchechi, U.F, Intelligent transportation systems, un-signalized road intersections and traffic congestion in Johannesburg: a systematic review. Procedia CIRP, 91,844-850, <https://doi.org/10.1016/j.procir.2020.04.137>. 2020. pp 1.
15. Claudia Nalleli Hernández Cerda, Alfredo Ávila Galarza, Diana Gabriela Cerda Alonso, Impacto de la movilidad urbana en la calidad del aire de la zona metropolitana de San Luis Potosí, México, DOI: <https://doi.org/10.15359/rca.57-1.8>. 2022. pp 1.
16. Piñan alcedo, caty carina. Huánuco. El impacto económico y medio ambiental generados por los vehículos menores motorizados en la ciudad de Huánuco 2022, [https://repositorio.unheval.edu.pe/bitstream/handle/20.500.13080/9203/T023\\_44426009\\_T.pdf?sequence=1&isAllowed=y](https://repositorio.unheval.edu.pe/bitstream/handle/20.500.13080/9203/T023_44426009_T.pdf?sequence=1&isAllowed=y). 2023. pp 8.

17. Limaylla cruz, Jhoel Jesús. Evaluación de la contaminación acústica en el centro urbano de la ciudad de Huánuco que influye en la calidad de vida de la población – 2019, [http://repositorio.un-dac.edu.pe/bitstream/unac/2344/1/T026\\_47244604\\_T.pdf](http://repositorio.un-dac.edu.pe/bitstream/unac/2344/1/T026_47244604_T.pdf). 2019. pp 58.
18. Contreras, Ella. Identificación del impacto ambiental y sus consecuencias en la ciudad de Huánuco. Available: <https://revistas.unheval.edu.pe/index.php/riv/article/view/1588/1558>. 2023. pp 6.
19. Pacheco Chávez Carlos Alberto, Vilchez Valverde Jesús Manuel, Carmona-Arteaga Abel, Neyra Torres José Luis, Monitoring of carbon monoxide (CO) with sentinel5P satellite images for the province of Huánuco, ISBN: 978-628-95207-4-3. ISSN: 2414-6390, <https://dx.doi.org/10.18687/LACCEI2023.1.1.400>. 2023. pp 9.
20. Luna Andrea, En el periodo de 'Koko' Giles se dieron más de 12 mil licencias falsas. Recuperado de <https://diariocorreo.pe/Perú/en-el-periodo-de-koko-giles-se-dieron-mas-de-12-mil-licencias-falsas-814334/>. 2018.
21. Berrospi, Jean P. Ecología acústica y el paisaje sonoro en una comunidad de Huánuco, Perú. <https://revistas.unheval.edu.pe/index.php/riv/article/view/344/328>. 2019. pp 7.
22. Hinojosa Lizangela, Vergara Alberto, Gómez Raúl, Quijada Edgar, Vargas Julio, Llacchua Faviola, Parque automovilístico: fuente de contaminación atmosférica, <https://journal.gnosiswisdom.pe/index.php/revista/article/view/63/59>. 2023. pp5.
23. Colqui, Samis [Tesis para optar el Título de Ingeniería Ambiental], Contaminación Acustica en puntos de congestión vehicular del casco urbano de Amarilis, provincia y región Huánuco – agosto y setiembre 2018, Huánuco: Universidad de Huánuco, <http://repositorio.udh.edu.pe/123456789/1648>. 2018. pp 10.
24. Dextre Juan Carlos, Aranda Fiorella, Proyecto Perú Debate 2021: propuestas hacia un mejor gobierno. Avanzando con resiliencia: Una “nueva movilidad” para Lima y Callao, ISBN N.º de depósito legal: 2021-04463, <https://gobierno.pucp.edu.pe/wp-content/uploads/2021/12/avanzando-con-resiliencia-una-nueva-movilidad-para-lima-y-callao.pdf>. 2021. pp 9.
25. Hokey Min. Assessing the Efficiency of Mass Transit Systems in the United States. [https://scholarworks.sjsu.edu/cgi/viewcontent.cgi?article=1226&context=mti\\_publications](https://scholarworks.sjsu.edu/cgi/viewcontent.cgi?article=1226&context=mti_publications). 2017. pp 12.
26. Vajjarapu Harshaa, Omkar Karmarkarb, Ashish Verma. Sustainable Urban Transport Policies to Improve Public Transportation System: A Case Study of Bengaluru, India. <https://doi.org/10.1016/j.trpro.2020.08.097>. 2019. Pp 2, 16.
27. Cal Y Mayor Rafael and Cárdenas James. Ingeniería de Tránsito. 9a Edición. ISBN: 9789587784152. 2018
28. Verástegui Ayala, Yessica Julia. Diseño de la ruta urbano turística para el área metropolitana de Huánuco basada en modelos de demanda de transporte. Universidad nacional de ingeniería. <http://hdl.handle.net/20.500.14076/20447>. 2019. pp 45-47.
29. Transporte Urbano: ¿Cómo resolver la Movilidad en Lima y Callao?. Mariana Alegre Escorza. 2016. [https://cies.org.pe/wp-content/uploads/2016/09/dp\\_transporte\\_urbano\\_sep.pdf](https://cies.org.pe/wp-content/uploads/2016/09/dp_transporte_urbano_sep.pdf). Pp33,34
30. Taxis Colectivos: ¿Por qué los usuarios prefieren este servicio de Transporte Urbano en San Isidro?. Tesis para obtener el título profesional de Ingeniera Civil. Cintia Miyuki Diaz Matsumoto. [https://tesis.pucp.edu.pe/repositorio/bitstream/handle/20.500.12404/22748/DIAZ\\_MATSUMOTO\\_CINTIA\\_TAXIS\\_COLECTIVOS\\_POR.pdf?sequence=1&isAllowed=y](https://tesis.pucp.edu.pe/repositorio/bitstream/handle/20.500.12404/22748/DIAZ_MATSUMOTO_CINTIA_TAXIS_COLECTIVOS_POR.pdf?sequence=1&isAllowed=y). 2022. pp 37,38.
31. Javier Romero-Torres, Javier García-Gutiérrez, Doricela Gutiérrez Cruz. Measurement of the quality of service of the informal transportation mode mototaxi in Mexico. <https://doi.org/10.1016/j.trip.2023.100764>. 2023. pp 1
32. Transport for London, <http://tfl.gov.uk>. 2018.

33. Seoul Solution, Reforming Public Transportation in Seoul, <https://www.seoulsolution.kr>. 2018.
34. EMTA, 2018, European Metropolitan Transport Authorities, <http://www.emta.com>. 2018.
35. Sánchez Franco, Myriam Laura y Mejía Carlos, El transporte masivo y su impacto en la movilidad urbana de Pachuca. <https://www.aacademica.org/carlos.mejia.reyes/51.pdf>. 2021. pp 9, 10.
36. Salvatore Trubia, Alessandro Severino, Salvatore Curto, Fabio Arena and Giovanni Pau. On BRT Spread around the World: Analysis of Some Particular Cities. <https://doi.org/10.3390/infrastructures5100088>. 2020. pp 11.
37. Robson Kathryn, Koorosh Gharehbaghi, Christina Scott-Young. Planning effective and efficient public transport systems, file:///C:/Users/usuario/Downloads/RobsonGharabaghiScott-Young2018InternatioanlJournalofRealEstateandLandPlanning6500-17356-3-PB.pdf. 2019. pp 7.
38. Tapia Vilma, Carbajal Luz, Vásquez Vanessa, Espinoza Rocío, Vásquez-Velásquez Cinthya, Steenland Kyle, Gonzales Gustavo. Traffic regulation and environmental pollution by particulate material (2.5 and 10), sulfur dioxide, and nitrogen dioxide in Metropolitan Lima, Perú. <http://dx.doi.org/10.17843/rpmesp.2018.352.3250>. 2023. pp 1.
39. Parra Sierra María Alejandra, Dohmen Charles, Puerto Chavez Lina, Pinzón García Sandra Milena, Buenas prácticas y recomendaciones para una política de transporte urbano sostenible, <https://www.kas.de/documents/287914/0/Buenas-pr%C3%A1cticas-de-transporte-urbano.pdf/0a8008cd-a30e-a8e0-fe1a-95c37acb5ac1?t=1638471299758>. 2021. pp 80-83.
40. Alfredo J. Ojeda Diaz, Víctor Cantillo, Julián Arellana. Understanding how individuals perceive changes in the built environment and the transport system after implementing a BRT system. The case of Barranquilla, Colombia. <https://doi.org/10.1016/j.jtrangeo.2023.103623>. 2023. pp 1.