

De: Ercilia Barrios Florez <ebarrios@transcaribe.gov.co>
Enviado el: martes, 15 de octubre de 2019 1:40 p. m.
Para: 'ingeniería@movilidadesostenible.com'
CC: lcaballero@transcaribe.gov.co; Yisad Gastelbondo (ygastelbondo18@gmail.com); ALVARO ENRIQUE TAMAYO JIMENEZ (atamayo@transcaribe.gov.co)
Asunto: SUBSANACION DE LA OFERTA
Importancia: Alta

Cartagena de Indias, D. T y C., 15 de octubre de 2019.

Señores;

**CONSORCIO CARTAGENA TC 2019,
integrado por MOVILIDAD SOSTENIBLE LTDA, TRANSPORTE PLANEACIÓN Y DISEÑO INGENIERIA S.A.,
y T&T TRANSITO Y TRANSPORTE INGENIERIA S.A.S.**

REPRESENTANTE LEGAL DEL CONSORCIO:

WILMER PIPICANO CHICANGANA

Presente.

Respetados señores;

En curso del proceso de verificación de la propuesta presentada por la Sociedad que Usted representa dentro del proceso de selección CONCURSO DE MERITOS No. TC-CPN-001-2019, cuyo objeto es "SELECCIONAR LA PROPUESTA MÁS FAVORABLE PARA LA ADJUDICACIÓN DE UN CONTRATO DE CONSULTORIA PARA LLEVAR A CABO LA ACTUALIZACIÓN DEL MODELO DE TRANSPORTE PÚBLICO Y DEL DISEÑO OPERACIONAL DEL SISTEMA INTEGRADO DE TRANSPORTE MASIVO DE LA CIUDAD DE CARTAGENA, SITM TRANSCARIBE", adelantado por ésta entidad, el comité evaluador solicita la siguiente subsanación:

- ✓ El documento de constitución del consorcio no señala expresamente "la imposibilidad de renunciar sin que exista un reemplazo debidamente notificado ante la entidad.", tal como lo exige el inciso 5o del numeral 6.1.2 del Pliego de Condiciones - Reglas de participación de consorcios y uniones temporales.
- ✓ El documento de constitución del consorcio no contiene la expresión "que ninguno de los integrantes del mismo se encuentra inhabilitado o tiene incompatibilidades para contratar con el Estado", tal como lo exige el inciso 5o del numeral 6.1.2 del Pliego de Condiciones - Reglas de participación de consorcios y uniones temporales.
- ✓ A folios 103, 104, y 105, de la oferta, se aportan manifestaciones de cada uno de los integrantes del proponente, de no estar incurso en causal de inhabilidad, incompatibilidad y conflictos de interés. No obstante, no se presenta certificación suscrita por el Representante Legal del Consorcio, relativa al Consorcio en si, tal como lo señala el Pliego de Condiciones, numeral 8.1 de los Pliegos de Condiciones, 1 - Capacidad Jurídica, inciso 9.

Observaciones relacionadas con el numeral 6.3.1. Organización del pliego de condiciones.

- **DIRECTOR DE CONSULTORÍA O DE PROYECTO:** La formación académica acreditada no cumple con las exigencias del pliego de condiciones.

Teniendo en cuenta lo anterior, por medio del presente solicitamos subsanar los mencionados requisitos. Para ello, otorgamos un plazo máximo **hasta el día MIÉRCOLES 16 DE OCTUBRE de 2019, 4:00 p.m.**

Esta solicitud se hace sin perjuicio de las siguientes que se puedan hacer.

ERCILIA BARRIOS FLOREZ
JEFE OFICINA ASESORA JURIDICA
TRANSCARIBE S.A.
Tel. 6665217 - EXT. 119



TransCaribe

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Ercilia Barrios Florez

De: Ercilia Barrios Florez <ebarrios@transcaribe.gov.co>
Enviado el: martes, 15 de octubre de 2019 1:46 p. m.
Para: 'ingenieria@movilidadesostenible.com'
Asunto: RV: SUBSANACION DE LA OFERTA

Importancia: Alta

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Importancia: Alta

Cartagena de Indias, D. T y C., 15 de octubre de 2019.

Señores;

CONSORCIO CARTAGENA TC 2019,
integrado por MOVILIDAD SOSTENIBLE LTDA, TRANSPORTE PLANEACIÓN Y DISEÑO INGENIERIA S.A.,
y T&T TRANSITO Y TRANSPORTE INGENIERIA S.A.S.

REPRESENTANTE LEGAL DEL CONSORCIO:

WILMER PIPICANO CHICANGANA

Presente.

Respetados señores;

En curso del proceso de verificación de la propuesta presentada por la Sociedad que Usted representa dentro del proceso de selección CONCURSO DE MERITOS No. TC-CPN-001-2019, cuyo objeto es "SELECCIONAR LA PROPUESTA MÁS FAVORABLE PARA LA ADJUDICACIÓN DE UN CONTRATO DE CONSULTORIA PARA LLEVAR A CABO LA ACTUALIZACIÓN DEL MODELO DE TRANSPORTE PÚBLICO Y DEL DISEÑO OPERACIONAL DEL SISTEMA INTEGRADO DE TRANSPORTE MASIVO DE LA CIUDAD DE CARTAGENA, SITM TRANSCARIBE", adelantado por ésta entidad, el comité evaluador solicita la siguiente subsanación:

- ✓ El documento de constitución del consorcio no señala expresamente "la imposibilidad de renunciar sin que exista un reemplazo debidamente notificado ante la entidad.", tal como lo exige el inciso 5o del numeral 6.1.2 del Pliego de Condiciones - Reglas de participación de consorcios y uniones temporales.

- ✓ El documento de constitución del consorcio no contiene la expresión "que ninguno de los integrantes del mismo se encuentra inhabilitado o tiene incompatibilidades para contratar con el Estado ", tal como lo exige el inciso 5o del numeral 6.1.2 del Pliego de Condiciones - Reglas de participación de consorcios y uniones temporales.
- ✓ A folios 103, 104, y 105, de la oferta, se aportan manifestaciones de cada uno de los integrantes del proponente, de no estar incurso en causal de inhabilidad, incompatibilidad y conflictos de interés. No obstante, no se presenta certificación suscrita por el Representante Legal del Consorcio, relativa al Consorcio en si, tal como lo señala el Pliego de Condiciones, numeral 8.1 de los Pliegos de Condiciones, 1 - Capacidad Jurídica, inciso 9.

Observaciones relacionadas con el numeral 6.3.1. Organización del pliego de condiciones.

- **DIRECTOR DE CONSULTORÍA O DE PROYECTO:** La formación académica acreditada no cumple con las exigencias del pliego de condiciones.

Teniendo en cuenta lo anterior, por medio del presente solicitamos subsanar los mencionados requisitos. Para ello, otorgamos un plazo máximo **hasta el día MIÉRCOLES 16 DE OCTUBRE de 2019, 4:00 p.m.**

Esta solicitud se hace sin perjuicio de las siguientes que se puedan hacer.

ERCILIA BARRIOS FLOREZ
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Propuesto 3.

Ercilia Barrios Florez

De: Movilidad Sostenible Ltda. <ingenieria@movilidadesostenible.com>
Enviado el: miércoles, 16 de octubre de 2019 12:48 p. m.
Para: ERCILIA DEL CARMEN BARRIOS FLOREZ
Asunto: Re: SUBSANACION DE LA OFERTA
Datos adjuntos: Subsanación Consorcio Cartagena TC 2019.pdf

Señores
TRANSCARIBE S.A.
Comité Evaluador
Cartagena D.T y C.

Referencia: CONCURSO DE MERITOS ABIERTO No. TC-CPN-001-2019.

Respetados Señores:

De forma atenta y respetuosa, el CONSORCIO CARTAGENA TC 2019 se permite presentar respuesta a las observaciones de verificación de requisitos del proceso Concurso de Méritos Abierto No. TC-CPN-001-2019, cuyo objeto es "Seleccionar la propuesta más favorable para la adjudicación de un contrato de consultoría para llevar a cabo la Actualización del Modelo de Transporte Público y del Diseño Operacional del Sistema Integrado de Transporte Masivo de la ciudad de Cartagena, SITM TRANSCARIBE".

cordialmente,

WILMER PIPICANO CHICANGANA
Representante Legal del Consorcio Cartagena TC 2019

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El mar., 15 oct. 2019 a las 13:46, ERCILIA DEL CARMEN BARRIOS FLOREZ
(<ebarrios@transcaribe.gov.co>) escribió:

ERCILIA BARRIOS FLOREZ

JEFE OFICINA ASESORA JURIDICA
TRANSCARIBE S.A.
Tel. 6665217 - EXT. 119



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CONSORCIO CARTAGENA TC 2019,

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y T&T TRANSITO Y TRANSPORTE INGENIERIA S.A.S.

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WILMER PIPICANO CHICANGANA

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✓ El documento de constitución del consorcio no señala expresamente "la imposibilidad de renunciar sin que exista un reemplazo debidamente notificado ante la entidad.", tal como lo exige el inciso 5o del numeral 6.1.2 del Pliego de Condiciones - Reglas de participación de consorcios y uniones temporales.

✓ El documento de constitución del consorcio no contiene la expresión "que ninguno de los integrantes del mismo se encuentra inhabilitado o tiene incompatibilidades para contratar con el Estado", tal como lo exige el inciso 5o del numeral 6.1.2 del Pliego de Condiciones - Reglas de participación de consorcios y uniones temporales.

✓ A folios 103, 104, y 105, de la oferta, se aportan manifestaciones de cada uno de los integrantes del proponente, de no estar incurso en causal de inhabilidad, incompatibilidad y conflictos de interés. No obstante, no se presenta certificación suscrita por el Representante Legal del Consorcio, relativa al Consorcio en sí, tal como lo señala el Pliego de Condiciones, numeral 8.1 de los Pliegos de Condiciones, 1 - Capacidad Jurídica, inciso 9.

Observaciones relacionadas con el numeral 6.3.1. Organización del pliego de condiciones.

- **DIRECTOR DE CONSULTORÍA O DE PROYECTO:** La formación académica acreditada no cumple con las exigencias del pliego de condiciones.

Teniendo en cuenta lo anterior, por medio del presente solicitamos subsanar los mencionados requisitos. Para ello, otorgamos un plazo máximo **hasta el día MIÉRCOLES 16 DE OCTUBRE de 2019, 4:00 p.m.**

Esta solicitud se hace sin perjuicio de las siguientes que se puedan hacer.

ERCILIA BARRIOS FLOREZ

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CONSORCIO CARTAGENA TC 2019

Bogotá D.C. 15 de octubre de 2019

Señores
TRANSCARIBE S.A.
Comité Evaluador
Cartagena D.T y C.

Referencia: CONCURSO DE MERITOS ABIERTO No. TC-CPN-001-2019.

Asunto: Respuesta a observaciones para subsanación de documentos.

Respetados Señores:

De forma atenta y respetuosa, el CONSORCIO CARTAGENA TC 2019 se permite presentar respuesta a las observaciones de verificación de requisitos del proceso Concurso de Méritos Abierto No. TC-CPN-001-2019, cuyo objeto es "Seleccionar la propuesta más favorable para la adjudicación de un contrato de consultoría para llevar a cabo la Actualización del Modelo de Transporte Público y del Diseño Operacional del Sistema Integrado de Transporte Masivo de la ciudad de Cartagena, SITM TRANSCARIBE", entregado el 15 de octubre de 2019, mediante correo electrónico, en los siguientes términos:

1. Documento de constitución del consorcio y certificación suscrita por el Representante Legal, relativa al consorcio

Se atiende observaciones, y se hace entrega en documentos anexos a la presente, para subsanar.

2. Observaciones relacionadas con el numeral 6.3.1. Organización del pliego de condiciones.

DIRECTOR DE CONSULTORÍA O DE PROYECTO

La formación académica acreditada no cumple con las exigencias del pliego de condiciones.

De acuerdo con los numerales del Pliego:

6.3.1. ORGANIZACIÓN: El proponente deberá ofertar dentro de su propuesta como requisito habilitante y evaluable, un equipo de trabajo mínimo requerido para la ejecución de la Consultoría.

7.2. CAPACIDAD TÉCNICA Y EXPERIENCIA DEL EQUIPO DE TRABAJO (290 puntos) A continuación, se relaciona el personal técnico mínimo calificable:

7.2.1. DIRECTOR DE CONSULTORÍA O PROYECTO (máximo 120 puntos): Para la verificación de este factor de evaluación el proponente deberá presentar como DIRECTOR DE CONSULTORÍA O PROYECTO, a un profesional INGENIERO CIVIL O DE



CONSORCIO CARTAGENA TC 2019

TRANSPORTES O DE VIAS, CON ESPECIALIZACIÓN, MAESTRÍA, DOCTORADO O POSTDOCTORADO en tránsito, transporte, vías o áreas afines, con una experiencia general mayor a quince (15) años y con una experiencia específica acreditada mayor de cinco (5) años, como gerente o director de consultoría en proyectos de estructuración, diseño, evaluación, estudios o investigaciones de sistemas de transporte urbano, que incluyan la realización de planes de movilidad, factibilidad, estimación de oferta y demanda para sistemas masivos, estudios de transporte; debidamente terminados y liquidados. Los criterios y subcriterios, y el sistema de puntos que se asignarán a la evaluación de las propuestas técnicas simplificadas son:

- *Experiencia Especifica del Director de Proyecto: Por cada año de experiencia específica adicional a la exigida por el contratante en el numeral 5.5.1., obtendrá 20 puntos, hasta un máximo de 80 puntos.*
- *Formación Académica del Director de Proyecto. Por maestría o doctorado en las áreas de la ingeniería de transportes o en gerencia de proyectos 40 puntos.*

Teniendo en cuenta lo anterior, se confirma que el profesional presentado para el cargo de Director de Proyecto cumple con la totalidad de los requisitos del pliego de condiciones, tanto de calificación habilitante, como de condiciones de capacidad técnica.

El profesional posee un pregrado en Ingeniería Civil (folio 352) y cuenta con dos posgrados: Título de Magister en Ingeniería de Tránsito y Transporte (folio 353) y un Doctorado en Filosofía en Ingeniería Civil con énfasis en Transporte (folio 354 al 357). Al respecto, es de aclarar que el título de posgrado: Doctorado en filosofía en Ingeniería Civil con énfasis en transporte, lo obtuvo culminando con éxito 63 créditos exigidos en asignaturas de Ingeniería de transportes, y que su tesis doctoral, de título: "Diseño de redes estructuradas de transportación colectiva incorporando en forma explícita los beneficios del usuario", tal como lo consta su título profesional (folio 354 al 357) y plan de estudios aportados, los cuales confirman su énfasis en ingeniería de transportes.

En consecuencia, respetuosamente solicitamos que la propuesta presentada por el proponente CONSORCIO CARTAGENA TC 2019 sea evaluada y calificada como HABILITADA, por parte de TRANSCARIBE S.A.

Cordialmente,

WILMER PIPICANO CHICANGANA

Representante Legal del Consorcio Cartagena TC 2019





Bogotá D.C., 15 de octubre de 2019.

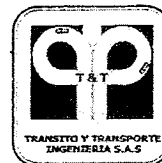
MANIFESTACIÓN SOBRE INHABILIDADES, INCOMPATIBILIDADES Y CONFLICTOS DE INTERÉS

El suscrito **WILMER PIPICANO CHICANGANA**, identificado con la cédula de ciudadanía No. 4.695.506 de La Vega Cauca, en calidad de Representante Legal del Consorcio Cartagena TC 2019, manifiesto que el **CONSORCIO CARTAGENA TC 2019** no está dentro de causal de inhabilidad o incompatibilidad, que ni los integrantes, ni el representante legal, ni los socios se encuentran en causal de inhabilidad o incompatibilidad para participar el proceso de contratación y suscripción del contrato con **TRANSCARIBE S.A.**

La presente se expide a los quince (15) días del mes de octubre del año dos mil diecinueve (2019).

Atentamente,


WILMER PIPICANO CHICANGANA 
C.C. No. 4.695.506 de La Vega Cauca
Representante Legal del Consorcio Cartagena TC 2019



CONSORCIO CARTAGENA TC 2019

OTRO SI No. 001 AL DOCUMENTO DE CONFORMACION DE CONSORCIO CARTAGENA TC 2019

Entre los suscritos a saber **CHRISTIAN ALBERTO PIPICANO LÓPEZ** mayor de edad, vecino de esta ciudad, identificado con cedula de ciudadanía N° 10.298.730 expedida en Popayán quien obra en nombre y representación legal de **Movilidad Sostenible Ltda.**, legalmente constituida, con domicilio principal en Bogotá D.C. con NIT No. 900.052.582-2 y debidamente facultado, **ALFREDO ARDILA ARIZA** mayor de edad, vecino de esta ciudad, identificado con cedula de ciudadanía No. 19.262.146 expedida en Bogotá D.C., quien obra en nombre y representación legal de **Transporte Planeación y Diseño Ingeniería S.A.**, legalmente constituida, con domicilio principal en Bogotá D.C., con NIT No. 830.034.108-4, y debidamente facultado, y **DEISY ANGELICA GUZMAN TOVAR** mayor de edad, vecino de esta ciudad, identificado con cedula de ciudadanía No. 52.021.146 en Bogotá D.C., quien obra en nombre y representación legal de **T&T Tránsito y Transporte ingeniería S.A.S.**, legalmente constituida, con domicilio principal en Bogotá D.C. con NIT No. 900.388.874-0 y debidamente facultados, hemos determinado suscribir el presente Otrosí 1 al documento de conformación de **CONSORCIO CARTAGENA TC 2019** de fecha 04 de octubre de 2019. Haciendo constar que contamos con facultades suficientes para el mismo otorgados por las sociedades que representamos. Este acuerdo se registrá por las siguientes cláusulas:

Aclaración clausula tercera:

TERCERA. – REPRESENTACION LEGAL: Se designa como representante al señor **Wilmer Pipicano Chicangana**, identificado con cedula de ciudadanía No. 4.695.506, expedida en La Vega Cauca, domiciliado en Bogotá D.C., cargo este que se entiende aceptado con la firma del presente documento y quien está autorizado para contratar, comprometer, negociar y representar al **CONSORCIO**, y la imposibilidad de renunciar sin que exista un reemplazo debidamente notificado ante la entidad. Igualmente, se nombran suplentes del representante del **CONSORCIO** a la señora **DEISY ANGELICA GUZMAN TOVAR** identificada con cedula de ciudadanía No. 52.021.146, expedida en Bogotá, domiciliada en Bogotá D.C. y al señor **ALFREDO ARDILA ARIZA** mayor



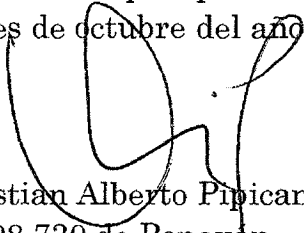
CONSORCIO CARTAGENA TC 2019

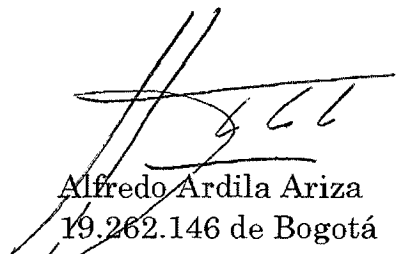
de edad, vecino de esta ciudad, identificado con cedula de ciudadanía No. 19.262.146 expedida en Bogotá, los cuales tendrán la facultad de reemplazar al representante legal de consorcio en sus faltas absolutas o temporales.

Adición clausula octava:

OCTAVA – INHABILIDADES, INCOMPATIBILIDADES Y CONFLICTOS DE INTERÉS: los integrantes que conforman el CONSORCIO: Movilidad Sostenible Ltda., Transporte Planeación y Diseño Ingeniería S.A., y T&T Tránsito y Transporte Ingeniería S.A.S, manifiestan que ninguno de los integrantes del mismo se encuentra incurso en ninguna de las causales de inhabilitado o tiene incompatibilidades para contratar con el Estado.

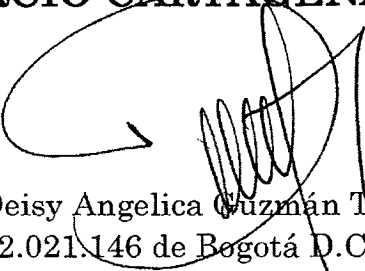
En constancia de lo anterior, se firma por quienes intervinieron en el presente documento a los 15 días del mes de octubre del año 2019.

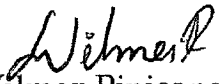

Acepto: Christian Alberto Pipicano López
C.C: 10.298.730 de Popayan
Representante Legal de: Movilidad Sostenible Ltda.
NIT: 900.052.582-2
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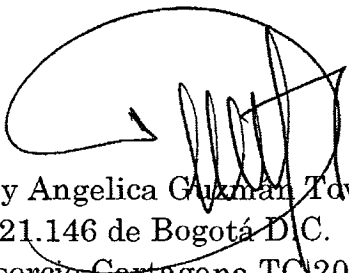

Acepto: Alfredo Ardila Ariza
C.C: 19.262.146 de Bogotá
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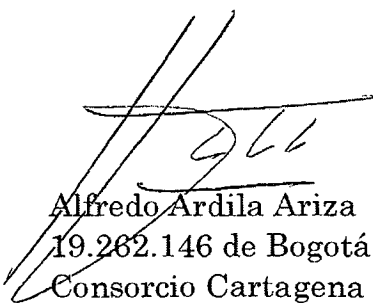


CONSORCIO CARTAGENA TC 2019


Acepto: Deisy Angelica Guzmán Tovar
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Representante Legal de: T&T Tránsito y Transporte Ingeniería S.A.S
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Tel: +57 (1) 7498976


Acepto: Wilmer Pipicano Chicangana
C.C: 4.695.506 de La Vega Cauca
Representante Legal de: Consorcio Cartagena TC 2019
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Acepto: Deisy Angelica Guzmán Tovar
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Acepto: Alfredo Ardila Ariza
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Tel: +57 (1) 3231705 - (1) 3231707



9 de octubre de 2019
Mayagüez, PR

Sr. Wilmer Pipicano Chicangana

INFORMACIÓN OFICIAL SOBRE SU GRADO ACADÉMICO

Estimado señor Pipicano:

De acuerdo a su petición, acompaño la información con relación al grado de doctorado que obtuvo en la Universidad de Puerto Rico, Recinto Universitario de Mayagüez, del Departamento de Ingeniería Civil y Agrimensura. Con relación a su petición de información sobre el contenido de las asignaturas cursadas, a continuación encontrará copia fiel del Catálogo del RUM en lo que respecta al programa de Ingeniería Civil y Agrimensura. También incluimos la información oficial describiendo los requisitos para obtener el grado de Doctorado en nuestro departamento. Se incluye su plan de estudios para doctorado que muestra los cursos que usted aprobó para cumplir con los requisitos. Este plan de estudios es copia fiel del original que consta en nuestros expedientes. Incluyo mis iniciales en las hojas para dar fe de que son oficiales. Todos los cursos en su plan de estudios fueron ofrecidos en la categoría presencial.

Perfil del egresado: Los profesionales egresados del programa serán capaces de resolver los problemas únicos y particulares de injerencia en su especialidad que día a día surgen en la industria, el gobierno y la comunidad general, tanto en Puerto Rico como en otros lugares del Globo. Las herramientas de análisis y diseño que lleven los egresados del programa serán del estado del arte en la literatura actual de su especialidad.

Los objetivos instruccionales del programa del Doctorado en Filosofía en Ingeniería Civil son preparar estudiantes graduados: (1) con destrezas de pensamiento crítico y destrezas de solución de problemas usando el método



científico, (2) que sean profesionales que valoren el estudio independiente y sean autodidactas, (3) que puedan identificar las variables relevantes de un problema físico, (4) que dominen destrezas matemáticas, (5) y sean competentes conceptual y cualitativamente en alguna de las áreas de Ambiental, Estructuras, Geotecnia, Ingeniería de Construcción y su Gerencia, o Transportación, (6) que tengan la capacidad de resolver problemas físicos mediante el análisis de sus partes, (7) que puedan formular aspectos básicos de los factores que contribuyen a un problema físico, (8) que puedan demostrar habilidad para llevar a cabo un proyecto de investigación supervisado, (9) que puedan comunicarse efectivamente en inglés y en español, (10) que estén al tanto de los temas actuales de la Ingeniería Civil, (11) y que estén conscientes de la ética profesional.

El programa tiene una duración de 4.5 años.

De requerir información adicional puede contactarme a su mejor conveniencia.

Cordialmente,



Dr. Ricardo R. López Rodríguez
Director Asociado para Estudios Graduados e Investigación



Form DAAEG-003
 Rev. Setiembre 2012

PLAN OF GRADUATE STUDY

The original of this record should be sent to the Registrar's Office during the student's second semester of graduate studies. A copy should be sent to the Office of Graduate Studies and a copy should remain in the Department.

1. Student's Name Wilmer Pipicano Chicangana		2. UPR ID Number 502-14-5170	
3. Degree: <input type="checkbox"/> MA <input type="checkbox"/> ME <input type="checkbox"/> MS <input type="checkbox"/> MBA <input checked="" type="checkbox"/> PHD		4. Plan (only for Master): <input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III	
5. Major: Civil Engineering		6. Option: Transportation	

7. Graduate Committee (3-5 members for Master's, 4-6 members for Doctorate). At least half of the members must belong to the student's graduate program.

Name	Highest Degree	Rank	Department	Signature
Chairperson: Dr. Didier M. Valdés Díaz	PhD	Professor	Civil Eng. & Surveying	
Dr. Sergio L. González Quevedo	PhD	Ad Honorem	Civil Eng. & Surveying	
Dr. Gabriel E. Sánchez Martínez	PhD	Ad Honorem	Civil Eng. & Surveying	
Dr. Dámaris Santana Morant	PhD	Associate Professor	Mathematics	

8. Deficiencies - up to four 3000 or 4000 level courses included in the admissions letter. The student must successfully complete these courses with a GPA of 3.00 or more during the first two years of study after admission to avoid suspension after the two-year period. A grade of D or F in any deficiency course would result in immediate suspension for one year as per the Certification 09-09 (Academic Senate):

Course Code	Title	Term	Credits

9. Graduate courses completed at other institutions, or previously at the Mayagüez Campus, for which transfer toward a graduate degree is being requested (students must successfully complete 60 percent of the courses in their plan of graduate study at UPRM).

Institution	Course Code	Course Title	Credits	Code of UPRM Course substituted	Type of UPRM course substituted (core ¹ , major ² or elective ³)
Universidad del Cauca		Ingeniería de Tránsito I	3	INCI 5146	Major
		Planeación Regional y Urbana	3	INCI 6046	Major
		Economía del Transporte	3	INCI 6049	Major
		Ingeniería de Tránsito II	3	INCI 6047	Major
		Diseño Geométrico de Vías	3	INCI 6090	Major

10. Courses taken or to be taken at the Mayagüez Campus. A maximum number of nine (9) at the 5000 level courses is permitted. Some programs do not have core courses. Please arrange the courses in order (first core, then major, then electives).

Course Code	Title	Term	Credits	Type (core ¹ , major ² or elective ³)
INCI 6119	Data Analysis Modeling Transport	1 st 2014-15	3	Major
ININ 6005	Experimental Statistics	1 st 2014-15	3	Major
INCI 6997	Special Topics (Human Factors in Transportation Engineering)	2 nd 2014-15	3	Major
INCI 6048	Transportation Systems Analysis	2 nd 2014-15	3	Major
INCI 6995	Special Problems (Advanced Analysis of Urban Bus Systems)	2 nd 2014-15	3	Major
INCI 6108	Road Safety Analysis	1 st 2015-16	3	Major
INCI 6051	Mass Transportation Systems	1 st 2015-16	3	Major
INCI 6050	Advanced Transport Systems Analysis	1 st 2015-16	3	Major
INCI 8999	Doctoral Research Thesis	1 st 2015-16	18	Major
ESMA 6305	Statistical Methods	1 st 2014-15	3	Elective
INTD 6007	English for International Students	1 st 2014-15	3	Elective
INCI 6077	Planning and Scheduling of Construction Projects	2 nd 2014-15	3	Elective

¹ Core - courses that must be taken by all students in a graduate program

² Major - courses central to the student's specialty




³ Electives - courses outside the immediate field of specialty (minimum 6 credits for Master, 9 for Doctorate)

STUDENT'S NAME: Wilmer Pipicano-Chicangana	UPR ID NUMBER: 502-14-5170
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11. Special examinations - qualifying, comprehensive, preliminary, etc. Special examinations can be taken twice.

Type of examination	Date passed	Date when the result was informed to the Registrar's office
Qualifying	November 2015	December 2015

12. This plan of graduate study is approved by:

Student:  Wilmer Pipicano-Chicangana	Coordinator of the Graduate Program:  Dr. Ricardo R. López-Rodríguez	Director of the Department:  Prof. Ismael Pagán-Trinidad
Date: 24 enero / 17	Date: 24 enero 17	Date: 24 enero 17

The original of this record should be sent to the Registrar's Office during the student's second semester of graduate studies. A copy should be sent to the Office of Graduate Studies and a copy should remain in the Department.

Graduate Catalogue

2018 - 2019



RPT.

UNIVERSITY OF PUERTO RICO

MAYAGÜEZ CAMPUS

OBJECTIVES:

Our Civil Engineering graduates will address the challenges that they will face in their careers, pursue life-long learning and continue to develop their problem-solving skills. They will also exhibit leadership and team-building skills in a bilingual setting, provide quality service to the profession, to our government, and to our society, and function as effective members of interdisciplinary teams.

COURSES OFFERED

(I)= courses normally offered during the First Semester

(II)= courses normally offered during the Second Semester

(S)= courses normally offered during the Summer Session

(BD)= based on demand

CIVIL ENGINEERING (INCI)

Advanced Undergraduate Courses

Ref.
INCI 5006. APPLIED HYDRAULICS (I). Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4138 or authorization of the Director of the Department.

Dimensional analysis and modeling; hydraulic machinery and structures; steady conduit and open channel flow; pipe network system.

INCI 5007. SOLID WASTE MANAGEMENT. Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4008 or authorization of the Director of the Department.

The solid waste problem: volume reduction and storage of solid wastes, design and optimization of collection systems, recycling, integrated treatment and disposal systems.

INCI 5008. INTRODUCTION TO HYDROLOGY. Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4138 or authorization of the Director of the Department.

The elements of the hydrologic cycle; probability theory and commonly used probability distributions in hydrology; hydrologic and hydraulic flood routing analysis; use of hydrologic concepts in design.

INCI 5009. FUNDAMENTALS OF AIR POLLUTION (II). Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4008 or authorization of the Director of the Department.

Classification and extent of air pollution problems, its effects on plants, animals, visibility, and its socio-economic impact; dispersion of effluents; analytical and experimental sampling methods.

INCI 5010. SUSTAINABLE CONSTRUCTION. Three credit hours. Three hours of lecture per week. Prerequisite: Fifth year student or graduate student or authorization of the Director of the Department.

Study of sustainable development and the application of sustainability to engineering design and construction. Discussion of the principles needed to support green design and construction, including the relationship between professional ethics and sustainability. In addition, topics such as the process to deliver and assess green buildings, the building system for resource optimization, the reduction on environmental impact, and the use of the integrated building design will be considered.

INCI 5012. APPLIED SANITARY ENGINEERING CHEMISTRY (II). Four credit hours. Three hours of lecture and one three-hour laboratory per week. Prerequisite: INCI 4008 or authorization of the Director of the Department.

The application of chemical principles to the sanitary engineering field. Physical, chemical, and biochemical analysis of water and wastewater. Interpretation of analytical data. Integration of experimental data into the design process. The preparation of laboratory reports in the form of engineering reports is emphasized.

INCI 5015. WATER TREATMENT AND POLLUTION CONTROL. Three credit hours. Two lectures and one three-hour laboratory per week. Prerequisite: INCI 4008 or authorization of the Director of the Department.

Study of water and wastewater treatment processes in terms of the underlying physical, chemical, and biological principles; the application of the principles to the study of unit treatment processes and to the design, operation, and analysis of performance of integrated treatment plants; the influence of the self-purification of natural bodies of water and of the planned use of the resources on the type and degree of treatment of waste and its disposal; wastewater reclamation.

INCI 5017. PRESTRESSED CONCRETE STRUCTURES (I). Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4012 or authorization of the Director of the Department. Corequisite: INCI 4022.

Prestressing systems and materials; stress losses, design of beams of flexure, bond, shear and bearing; specifications and economics of design.

INCI 5018. MATRIX ANALYSIS OF STRUCTURES I (I). Three credit hours. Three hours of lecture per week. Prerequisites: INCI 4022 and authorization of the Director of the Department.

Use of matrix methods in the analysis of structures; flexibility and stiffness methods.

INCI 5021. INTRODUCTION TO DYNAMICS OF STRUCTURES. Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4022 or authorization of the Director of the Department.

Study of the modeling of structures as systems of single and multiple degrees of freedom. Explanation of the calculation of natural frequencies and vibration modes. Use of computer programs for the dynamic analysis of structures. Introduction of the concept of response and design spectra along with their use for the calculation of the response to earthquake loads.

INCI 5026. BRIDGE DESIGN (II). Three credit hours. Three hours of lecture per week. Prerequisites: (INCI 4012 and INCI 4022) or authorization of the Director of the Department.

Bridge analysis and design; bridge types, characteristics; design problems.

INCI 5027. MODEL ANALYSIS OF STRUCTURE (BD). Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INCI 4022 or authorization of the Director of the Department.

Model analysis in structural engineering; similarity of structures; theory of models of trussed and framed structures and shells; direct and indirect model analysis of structures.

INCI 5029. PRINCIPLES OF CITY PLANNING. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

The scope of and legislative bases for planning, organization of planning agencies, basic studies for studies for planning, public utilities and related

service facilities, transit and transportation systems, recreation and related service facilities, transit and transportation systems, recreation and public spaces, land use planning, zoning, land subdivision regulations, economic and social aspects of planning, local, regional and national levels of planning.

INCI 5047. INTRODUCTION TO ROCK MECHANICS (BD). Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4139 or INCI 4031 or authorization of the Director of the Department.

Fundamentals of rock mechanics; properties of rocks; strength and deformation characteristics of intact and *in-situ* rocks, computation of internal stresses in a rock mass; methods of rock exploration; application of rock mechanics.

INCI 5049. GEOSYNTHETICS IN CIVIL ENGINEERING (II). Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4139 or authorization of the Director of the Department.

Manufacture, properties and test methods of the different products that comprise the geosynthetics. Applications in: drainage and filtration, design of pavements, earth retaining structures, systems of pollution control, sanitary landfills and other environmental projects.

INCI 5055. DESIGN OF TIMBER STRUCTURES (II). Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4021 or authorization of the Director of the Department.

Physical and mechanical properties of solid and laminated wood; design and behavior of flexural, tension, and compression members; design of timber connections and mechanical fasteners; special problems in the design of wood trusses, shear walls, diaphragms and plywood composite beams.

INCI 5056. STRUCTURAL ANALYSIS III. Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4022 or authorization of the Director of the Department.

Application of methods for analysis of statically indeterminate structures. Moment distribution. Slope deflection and energy theorems.

INCI 5057. DESIGN OF REINFORCED CONCRETE STRUCTURES. Three credit hours. Two hours of conference and one hour of computation per week. Prerequisites: (INCI 4012 and INCI 4022) or authorization of the Director of the Department.

Design of concrete buildings, review of the design of slabs, beams and columns applied to buildings using the new seismic design codes, design of two-way slab systems, shear walls, typical foundations, retaining walls and design for torsion. Discussion of examples related to a complete structural design of a multistory building including the preparation of construction drawings.

INCI 5065. PRODUCTION OF BITUMINOUS MATERIALS. Three credit hours. Two hours of lecture and one three-hour laboratory per week. Prerequisite: INGE 4001 or authorization of the Director of the Department.

Study of the production of bituminous materials, the distillation process, and products applicable to the construction and rehabilitation of flexible pavements. Laboratory tests and trials for the characterization of such materials according to current standards. Design of bituminous mixtures for different types of pavement construction.

REF.
INCI 5146. INTRODUCTION TO TRAFFIC ENGINEERING (I). Three credit hours. Three hours of lecture per week. Prerequisite: INCI 4137 or authorization of the Director of the Department.

Operation and geometric analysis and design of intersections, Interrupted traffic flow theory, queuing theory, capacity and level of service, traffic studies, service models for signalized intersections and traffic simulation models.

INCI 5995. SPECIAL TOPICS (II). One to six credit hours. The contact will vary according to the topic to be presented. Prerequisite: authorization of the Director of the Department.

The topics will be presented by visiting professors and members of the department who are specialists in the field to be covered. The selection and scope of the topics shall be in accordance with the interests and needs of the students.

INCI 5996. SPECIAL PROBLEMS (BD). One to six credit hours. The contact will vary according to the topic to be presented. Prerequisite: authorization of the Director of the Department.

Research and special problems in Civil Engineering and related fields. Open to outstanding students in the field of Civil Engineering.

Graduate Courses

INCI 6005. WATER AND WASTEWATER TREATMENT (II). Three credit hours. Three hours of lecture per week. Prerequisite: authorization of Department Director.

The process of treating water and wastewater; design of facilities for treatment of water for municipal and industrial use; principles for treatment of municipal and industrial wastewater; application of unitary processes in the design of treatment plants to meet industrial effluents guidelines.

INCI 6006. GROUNDWATER HYDROLOGY (II). Three credit hours. Three hours of lecture per week. Prerequisite: authorization of Department Director.

Fundamentals of groundwater hydrology: well hydraulics, groundwater quality, surface and subsurface factors affecting groundwater, and seawater intrusion.

INCI 6008. WATER RESOURCES SYSTEMS (II). Three credit hours. Three hours of lecture per week. Prerequisite: authorization of Department Director.

Systems theory and operation research for solving typical water resources problems quantitatively and qualitatively; aspects of engineering economics, the concepts of the discount rate, methods of project evaluation, stochastic and deterministic simulation.

INCI 6009. WATER AND WASTEWATER TREATMENT LABORATORY (II). Three credit hours. One hour of lecture and six hours of laboratory per week.

Physical, chemical and biological processes in the treatment of water and waste water. Waste analysis, biodegradation, and waste water characterization.

INCI 6015. SANITARY ENGINEERING MICROBIOLOGY (BD). Three credit hours. Two hours of lecture and one three-hour laboratory per week.

Biochemical reactions induced by microorganisms, emphasizing microbiological processes related to water and wastewater treatment and to environmental pollution control.

INCI 6016. STOCHASTIC HYDROLOGY (BD). Three credit hours. Three hours of lecture per week. Prerequisite: authorization of Department Director.

Probability theory applied to hydrology; extreme value distribution; recurrence and frequency analysis; stochastic simulation of the hydrological process; hydrological models.

INCI 6017. STRUCTURAL MECHANICS (I). Three credit hours. Three hours of lecture per week.

Advanced theories of mechanics of materials are discussed with emphasis on topics most relevant to the civil engineering structures. The selection includes thin-walled cross sections subject to unsymmetrical bending and torsion, Mohr's circle for second moments of area, shear center of monosymmetric and unsymmetric sections, beams on elastic foundation, curved beams, thin shells of revolution subject to axisymmetric loading, and the limit states associated with fatigue, fracture and creep. Case studies on metal roof systems, long span beams, and liquid storage tanks are used to augment the theory.

INCI 6018. FINITE ELEMENT ANALYSIS OF STRUCTURES (II). Three credit hours. Three hours of lecture per week. Prerequisite: Authorization of the Director of the Department.

The finite element method and its application in the analysis of structures with elastic and non-linear behavior and in the determination of buckling loads, element development for the solution of unitary stress and strain problems in flexion of plates, thin and thick shells, axisymmetric shells, and solids.

INCI 6019. DESIGN OF STEEL STRUCTURES (I). Three credit hours. Three hours of lecture per week.

Evaluation of current specifications for the design of structural members under axial, flexure, torsional, and combined axial and flexural loadings; design of plate girders and rigid frames; plastic design of gable and multistory frames; design of connections for fatigue loading.

INCI 6020. OPTIMIZATION IN STRUCTURAL DESIGN (II). Three credit hours. Three hours of lecture per week.

Application of linear programming to the optimization of the design of steel and reinforced concrete frames subject to gravitational and lateral loads.

INCI 6021. THEORY OF ELASTICITY. Three credit hours. Three hours of lecture per week. Prerequisites: INCI 6017 or authorization of the Director of the Department.

Presentation of the theory to analyze stresses and strains in three-dimensional elastic solids presuming constitutive elastic equations. Formulation of models based on differential equations for the explicit solution of simple problems in the classic literature. Study of alternate formulations of virtual work and its changes due to variations in displacements and forces, small and large deformations, and fundamentals of thermoelasticity.

INCI 6022. DESIGN OF EARTHQUAKE RESISTANT STRUCTURES. Three credit hours. Three hours of lecture per week. Prerequisite: Authorization of the Director of the Department.

Study of the parameters used for the selection of a Design Earthquake, development of ground spectra, elastic and inelastic design spectra. Design of structures using the capacity method. Introduction to base isolation systems.

INCI 6023. ANALYSIS OF STRUCTURES OF COMPOSITE MATERIALS. Three credit hours. Three hours of lecture per week.

Analysis of the mechanical and physical properties of composite materials from the micromechanical to the macromechanical level. Laminate analysis including failure theories. Analysis, design, and optimization of structural elements and of concrete reinforced with composite materials. Study of the manufacture of components and analysis of connections between elements.

INCI 6025. PLAIN AND REINFORCED CONCRETE (II). Three credit hours. Three hours of lecture per week.

Brief review of the theories used in the design of concrete and the factors affecting the properties and behavior of the material and of the test specimen; behavior of plain concrete under different types of environment and of loading; critical review of ultimate strength; behavior of reinforced concrete members and relation between results of research and current specifications for design.

INCI 6026. REINFORCED CONCRETE STRUCTURES (I). Three credit hours. Three hours of lecture per week. Prerequisite: INCI 6025.

Continuation of INCI 6025. Ultimate strength and behavior of statically indeterminate reinforced concrete structures; floors, slabs; specifications.

INCI 6027. ADVANCED STRUCTURAL PROBLEMS (BD). Three credit hours. Three hours of lecture per week.

Advanced design of complex structural projects.

INCI 6029. DESIGN OF STRUCTURES FOR DYNAMIC LOADS (II). Three credit hours. Three hours of lecture per week.

Free vibrations; forced vibrations and transient response of structures having one or more degrees of freedom; damping and inelastic action; nature of dynamic loading from earthquakes and bomb blasts; methods of analysis and criteria for designing earthquake-resistant and blast-resistant structures.

INCI 6030. ANALYSIS OF STRUCTURAL SYSTEMS IN THE NON-LINEAR REGIME (BD). Three credit hours. Three hours of lecture per week.

Nature of the problem of non-linear behavior. Tangent stiffness method. Structures on elastic foundations. Soil and structure interaction.

INCI 6031. ADVANCED SOIL MECHANICS I (II). Three credit hours. Three hours of lecture per week.

One-dimensional consolidation; advances in consolidation theories; secondary consolidation; precompression; three-dimensional consolidation; sand drains; distribution of stresses in a soil mass; computation of settlements.

INCI 6032. MEASUREMENT OF SOIL PROPERTIES. Two hours of lecture and one three-hour laboratory per week.

Study and practice of the measurement of stress-strain and consolidation properties of soils including tests such as one-dimensional consolidation, direct shear, and triaxial tests. Practice in sample preparation, testing details, sources of error, analysis and interpretation of results, and report preparation is included.

INCI 6037. APPLIED SOIL MECHANICS (BD). Three credit hours. Three lectures per week.

Application of soil mechanics to earth pressure and retaining walls; foundations of buildings; stability of earth slopes; braced cuts; settlement and contact pressure; seepage.

INCI 6038. FOUNDATION ENGINEERING (I). Three credit hours. Three hours of lecture per week.

Case histories of projects in foundation engineering; design and construction procedures for foundations, embankments and other civil engineering earthworks.

INCI 6045. PAVEMENT DESIGN (I). Three credit hours. Three lectures per week. Prerequisite: INCI 4031.

Traffic loads, climatic effects, stresses in pavements, flexible pavement design, rigid pavement design, skid resistance, construction practices and maintenance.

INCI 6046. URBAN TRANSPORTATION PLANNING (II). Three credit hours. Three hours of lecture per week.

Urban travel characteristics and trends; basic urban transportation studies, including origin, destination surveys, inventory, use studies, parking studies, and transit surveys; application of transportation, economic, land use data in estimating future travel; planning arterial street and expressway systems, off street parking, and transit systems; coordination of city planning and transportation engineering; metropolitan transportation administration and finance.

INCI 6047. TRAFFIC ENGINEERING (I). Three credit hours. Two hours of lecture and one two-hour discussion, computation or field period per week.

City and highway traffic surveys and designs; accidents, congestion, delay, speed, volume density, parking, channelization, lighting, traffic control and routing, signs, signals and markings, urban traffic consideration in city planning; driver reactions and habit patterns.

INCI 6048. TRANSPORTATION SYSTEMS ANALYSIS (II). Three credit hours. Three hours of lecture per week.

Principles and techniques of systems analysis and mathematical programming are presented and applied to economic, physical planning, and the evaluation and operation of transportation facilities. Mathematical models are used to examine problems related to optimum efficiency of transportation systems and modes. Operations research methods of linear programming, non-linear programming, network analysis, queueing theory, and simulation are studied.

INCI 6049. TRANSPORTATION SYSTEMS EVALUATION (II). Three credit hours. Three hours of conference per week.

The course is designed to provide graduate students with knowledge of evaluation studies and methods employed in planning the proper function and character of transportation facilities, and of the broad administrative policies such as transportation needs, finance, and economics that affect the planning, design, and programming of transportation systems. The course contents give attention to the application of basic techniques in engineering economic evaluation and the assessment of user and non-user impacts of transportation improvements.

INCI 6050. ADVANCED TRANSPORTATION SYSTEMS ANALYSIS (On demand). Three credit hours. Three hours of lecture per week. Prerequisite: INCI 6048.

Advanced topics in transportation and demand analysis; transportation economy; resource models; techniques for the design and generation of alternatives in transportation systems.

INCI 6051. MASS TRANSPORTATION SYSTEMS. Three credit hours. Three hours of lecture per week.

Study of concepts related to the planning and operation of mass transportation systems in urban areas. Discussion and comparison of diverse modes of mass transport. Detailed study of urban rail systems.

INCI 6055. CONSTRUCTION COSTS ESTIMATES. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study of construction cost-estimating techniques during the different phases of the construction process. Development and application of knowledge and skills necessary to estimate costs in a construction project.

INCI 6057. THEORY OF ELASTIC STABILITY (II). Three credit hours. Three hours of lecture per week.

Bending of prismatic bars subjected to axial and lateral loads; buckling of compression members on the elastic and inelastic ranges; lateral buckling of beams, and torsional buckling.

INCI 6059. MODELING OF URBAN STORM DRAINAGE (I). Three credit hours. Three hours of lecture per week.

Application of hydrologic and hydraulic principles to the analysis, design, and management of urban drainage and small watersheds; computer modeling

and simulation; effects of spatial and temporal rainfall variabilities; overland flow; runoff from highways; stormsewers, culverts, and other related drainage structures.

INCI 6060. POLLUTANT TRANSPORT (I). Three credit hours. Three hours of lecture per week.

Point and non-point source pollutants; the Streeter-Phelps equation; analysis of the transport problem in streams and estuaries; finite element approach to system analysis; ocean outfalls; pollutographs and loadgraphs; universal equation of soil conservation, mathematical model for pollutants handling.

INCI 6061. SEDIMENT TRANSPORT I. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Introduction to sediment transport. Hydrodynamics of fluid-particle systems. Initiation of particle motion. Relation of bedforms to flow regime. Design of stable channels and live bed stable channels. Bedload and suspended sediment transport. Local scour in channels measurement of sediment transport.

INCI 6063. COMPUTER HYDROLOGIC MODELING (II). Three credit hours. Three hours of lecture per week.

Emphasis on computer hydrologic modeling. Application of the Hydrologic Cycle's components to the development of precipitation-runoff models. Individual watershed processes are analyzed and their integration to computer models studied. Model selection and calibration techniques, with special attention to error analysis, are also studied. Students are exposed to actual problems of using Hydrologic Models. Class projects include applications to real cases.

INCI 6064. ADVANCED CONCRETE TECHNOLOGY (BD). Three credit hours. Three hours of lecture per week.

Microstructure, physical and mechanical properties of concrete; strength-porosity relation, failure modes, and behavior of concrete under various stress states; fiber reinforced cementitious composites: types, mechanical properties, applications, and mixture proportions; fiber-reinforced shotcrete: applications and field performance; fiber reinforced plastics (FRPs): applications for repair, rehabilitation, and reinforcement.

INCI 6065. ENGINEERING PROJECT (I, II). Three to six credit hours.

Comprehensive study of a specific civil engineering problem selected so as to integrate the knowledge acquired in the graduate program of study. This project fulfills one of the terminal requirements of the Master of Engineering Program and will be governed by the norms established for this purpose.

INCI 6066. RESEARCH THESIS (I, II). One to six credit hours.

Research in the field of civil engineering and presentation of a thesis.

INCI 6068. PAVEMENT MANAGEMENT. Three credit hours. Three hours of lecture per week.

Development of systematic methods to evaluate and administer existing pavements for highways and airports. Analysis of existing pavement defects, structural capacity, safety, and geometry. Development and application of statistical models, optimization techniques, and analysis of rehabilitation techniques for existing pavements. Field project required.

INCI 6069. SOIL DYNAMICS (BD). Three credit hours. Three hours of lecture per week.

Introduction to the terminology and notation used in the analysis of dynamic systems. Discussion of dynamic soil properties and wave propagation theories in soils. Design of foundations in seismic regions, theory of machine vibrations, and the problem of soil liquefaction in granular soils. Description of laboratory dynamic tests and analysis of the data obtained from them.

INCI 6070. CONSTRUCTION ADMINISTRATION AND INSPECTION. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study of the concepts and processes related to the administration and inspection of construction projects. Discussion of the organization and scheduling of a project, applicable laws and regulations, specifications, quality control, safety, and other administrative aspects.

INCI 6076. PHYSICO-CHEMICAL TREATMENT OF WATER (I). Three credit hours. Three hours of lecture per week.

Theory and applications of physico-chemical unit processes for the removal of pollutants from water

and wastewater; substitution of biological treatment by physico-chemical processes; problems and technology of wastewater reuse for drinking purposes.

INCI 6077. PLANNING AND SCHEDULING CONSTRUCTION PROJECTS. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study of the concepts of planning and scheduling construction projects. Emphasis on division of the project into activities and the estimation of their duration; bar charts; development of networks by CPM and PM and their analysis using PERT. Scheduling with limited resources and resource leveling and the use of the schedule as a project control mechanism.

INCI 6078. SHEAR STRENGTH OF SOILS. Three credit hour. Three hours of lecture per week.

Studies of the physico-chemical properties of soils and the mechanisms of shearing resistance. Discussion of residual shear strength, Hvorslev's parameters, drained and undrained shear strength, and long-term shear strength.

INCI 6080. ANALYSIS AND DESIGN OF DEEP FOUNDATIONS. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Analysis and design of single and grouped piles subjected to axial and lateral forces, drivability analysis, and practical recommendations for pile driving. Design and interpretation of load test considering negative skin friction effects, and design of drilled shafts.

INCI 6085. ADVANCED MATHEMATICAL METHODS IN CIVIL ENGINEERING. (BD). Three credit hour. Three hours of lecture per week.

Advanced calculus; optimization methods, estimation theory; sampling theory; queuing theory; application of spread sheet and data base programs in microcomputers.

INCI 6086. STATISTICAL METHODS IN WATER RESOURCES. Three credit hours. Three hours of lecture per week.

Application of probabilistic methods to problems in water resources. Study of the probability distributions of rainfall and runoff processes. Analysis of random variables and hypothesis testing; frequency analysis of extreme events; correlation

and regression analysis in water resources; fundamentals of uncertainty and risk analysis.

INCI 6087. CONSTRUCTION COST ENGINEERING AND FINANCIAL MANAGEMENT. Three credit hours. Three hours of lecture per week.

Study of techniques and technologies required to achieve success in construction projects through improved cost control. Fundamental concepts related to cost control, financial management, advanced engineering economics, accounting, project control systems, and cash flow analysis applied to construction. The use of computer software for cost control and accounting will be explained.

INCI 6088. ENGINEERING GROUND IMPROVEMENT. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study of the methods of ground and site improvement to mitigate construction problems under poor engineering conditions. Description of design techniques for dewatering systems and ground improvement techniques applied to diverse systems including: compaction, preloading, vertical drains, admixtures, grouting, reinforced earth, in-situ densification, stone columns, slurry trenches, and relevant uses of geotextiles.

INCI 6089. ADVANCED STRUCTURAL DYNAMICS. Three credit hours. Three hours of lecture per week. Prerequisite: INCI 6029 or authorization of the Director of the Department.

Variational formulation of the equations of motion and of the equations of motion in state space, including the use of complex eigenvalues and eigenvectors. Study of free and forced vibrations of continuous systems using the frequency response method. Introduction to nonlinear vibrations and to wave propagation in unidimensional finite, semi-infinite, and infinite media.

INCI 6090. GEOMETRIC DESIGN OF HIGHWAYS. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study of geometric design concepts and policies used to design highways and streets, at-grade intersections, grade separations, interchanges, and other ground transportation facilities. Application of design control and criteria and consideration of the safety and operational effects of the roadway and roadside elements, the sight distance, the horizontal

and vertical alignment, and other elements of the design of roads of different functional classification.

INCI 6098. REHABILITATION OF REINFORCED CONCRETE STRUCTURES (BD). Three credit hours. Three hours of lecture per week.

Discussion of the available techniques to compute the maximum load capacity of a structure, estimates of expected gravity and lateral loads, and determination of the actual safety factor of the structure under the imposed load. Reinforced concrete pathology and prognosis of the problems caused by materials' defects, construction problems, and inadequate design. Techniques for strengthening structural elements. Presentation and discussion of typical cases.

INCI 6099. CONSTRUCTION METHODS AND EQUIPMENT. Three credit hours. Three hours of lecture per week.

Study of construction methods and equipment for civil engineering projects. Selection, layout, and organization of construction installations, equipment, and resources. Analysis of cost, operation, and productivity of equipment and construction methods. Field trips are required.

INCI 6100. STRUCTURAL COMPONENTS IN GEOTECHNICAL ENGINEERING. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Analysis and design of individual and combined foundations, mat foundations, cantilever retaining walls, and pile caps. Rigid and flexible method of analysis of combined and mat foundations will also be studied.

INCI 6105. EARTH PRESSURES AND SHALLOW FOUNDATIONS. Three credit hours. Three hours of lecture per week.

Application of soil mechanics concepts to earth pressure and retaining structures, foundations of buildings, sheet piles, braced cuts, settlement, and contact pressures. Analysis and design of shallow foundations, retaining structures, sheet piles, and braced cuts.

INCI 6106. TEMPORARY STRUCTURES IN CONSTRUCTION. Three credit hours. Three hours of lecture per week. Prerequisite: Authorization of the Director of the Department.

Study of the fundamental concepts related to the selection, design, and layout of temporary structures

needed in construction. Safety issues, prefabricated and customized structures, use of pumps during construction, ramps, runways, and scaffolding, and design and analysis of frameworks for concrete structures will also be discussed.

INCI 6107. DURABILITY OF CONSTRUCTION MATERIALS. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Development of the analysis and design skills necessary to build public work in challenging environments. Study of the construction materials' lifecycle to provide a high level of expertise in areas such as: cement chemistry, aggregate science, binder technology, microstructure, and transportation mechanisms in concrete, concrete durability, alternative materials, durability of non-cement based materials, and material's performance.

INCI 6108. ROAD SAFETY ANALYSIS. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

RAAF
Study of the analytical methods used to estimate and analyze the safety effects and the relationships between different elements and characteristics of drivers, vehicles, traffic flow, and highway design. Analysis of crash, traffic and roadway inventory databases, the consideration of human factors and driver responses to risk perception. Application of conventional safety modeling techniques and methods for identifying hazardous locations, and recognize causes for different crash types.

INCI 6109. PRODUCTIVITY ANALYSIS AND SIMULATION IN CONSTRUCTION. Three credit hours. Three hours of lecture per week.

Study of the techniques and technologies used to manage productivity and methods of improvement in construction. Study of productivity measurement including work sampling, crew balance charts, process charts, and flow diagrams. Application of simulation to construction to illustrate how discrete event simulation can be used for productivity studies and for the design of complex and dynamic operations.

INCI 6115. PROGRAMMING METHODS IN CIVIL ENGINEERING (BD). Three credit hours. Three hours of lecture per week.

Implementation of numerical methods and algorithms for the solution of linear and non-linear systems of equations. Development and implementation of design systems and computer

graphics (CAE/CAD). A comprehensive programming project will be required.

INCI 6116. HYDROLOGICAL AND HYDRAULIC MEASUREMENT METHODS. Three credit hours. One hour of lecture and one six-hour workshop per week.

Utilization of field equipment, sampling techniques, and data analysis for hydrological and hydraulic applications. Field work is required.

INCI 6118. BIOREMEDIATION: PRINCIPLES AND APPLICATIONS. Three credit hours. Three hours of lecture per week.

Design and management of bioremediation projects. Topics in bioremediation include: site characterization, project management, subsoil microbial systems, biotransformation pathways of hazardous contaminants, and bioremediation technologies to solve environmental problems. The relationship among the physiological traits of microorganisms, the physicochemical properties of the contaminants, and the nature of the remediation environment will be emphasized.

INCI 6119. DATA ANALYSIS AND MODELING OF TRANSPORTATION SYSTEMS. Three credit hours. Three hours of lecture per week. Prerequisite: authorization of the Director of the Department.

Study of the variety of analytical tools that are regularly applied to data collected for transportation research studies. Emphasis on the use of model estimation methods as well as software packages helpful in the analysis of data for improving research in transportation engineering.

INCI 6125. UNSTEADY FLOW IN CLOSED CONDUITS. Three credit hours. Three hours of lecture per week.

Study of the principles of unsteady flow in closed-conduits, wave propagation and its causes. Derivation of the equations that describe unsteady flow and its limitations. Discussion of the numerical methods for computer solution of unsteady flow problems. Consideration of boundary conditions and methods for controlling unsteady flow. Development of computer programs for transient unsteady flow simulation.

INCI 6127. UNSTEADY FLOW IN OPEN CHANNELS. Three credit hours. Three hours of lecture per week.

Detailed study of the St. Venant equations for unsteady open channel flow. Derivation of the

differential of shallow-water equations. Modern methodologies to solve unsteady open-channel flow problems using computers. Applications to surge problems and dam breaks and introduction to methods of flow routing. Development of computer programs and use of well-known software to solve real life applications.

INCI 6130. PEDESTRIAN AND BICYCLE TRANSPORTATION. Three credit hours. Three hours of lecture per week.

Study and analysis of current practices related to the planning, design, operation, and maintenance of pedestrian and bicycle facilities. Identification of access and mobility needs and challenges of pedestrians and cyclists and their integration in the development of safe and sustainable transportation infrastructure systems.

INCI 6150. SLOPE STABILITY. Three credit hours. Three hours of lecture per week.

Study and analysis of soil and rock slope stability including the aspects of design and stabilization within a geotechnical framework.

INCI 6205. CONSTRUCTION CONTRACTING FOR ENGINEERS AND CONSTRUCTION PROFESSIONALS. Three credit hours. Three hours of lecture per week.

Study of the fundamental principles for contracting in the construction industry including topics such as: legal obligations for the parties, formation principles, contracts for architectural and design services, construction contracts, subcontractor agreements, description of commercial terms.

INCI 6206. PRECAST CONCRETE CONSTRUCTION. Three credit hours. Three hours of lecture per week.

Study of precast concrete, the benefits of prefabrication and its applications. Emphasis of the use of precast concrete for innovative and modern designs. Development of expertise in precast construction philosophy, principles, and systems. Study of precast detailing, stability, and key issues such as fire resistance and sustainability.

INCI 6207. PROCUREMENT OF INFRASTRUCTURES. Three credit hours. Three hours of lecture per week.

Study of the engineering, technical and organizational issues related to the procurement of infrastructure. Analysis of the scientific principles, practical information, decision-making, pecuniary

as well as socio-economic aspects of civil engineering infrastructures. Discussion of sector profiles and developments, issues and options, planning principles, as well as practices, funding and cost recovery of public works.

INCI 6208. BUILDING CONSTRUCTION SYSTEMS. Three credit hours. Three hours of lecture per week.

Study of the general characteristics of building materials, codes and standards, and construction methods pertaining to soils, foundations, wood, masonry, concrete, steel, and cladding and roofing systems. Discussion of the fundamental aspects of mechanical and electrical systems for buildings.

INCI 6209. ENVIRONMENTAL IMPACT ANALYSIS. Three credit hours. Three hours of lecture per week.

Description of environmental assessment fundamentals. Planning of the environmental assessment process including impact identification, environmental assessment indicators, prediction and assessment of impacts on environmental, social, economic, and cultural settings. Evaluation of alternatives including methods of decision making and preparation of environmental documents.

INCI 6306. SEEPAGE AND CONSOLIDATION. Three credit hours. Three hours of lecture per week. Prerequisites: Authorization of the Director of the Department.

Principles of steady state and transient seepage flow in soils, governing differential equations for unconfined and confined seepage flow problems. Graphical, analytical, and numerical solutions of seepage flow in homogeneous and layered soils with both isotropic and anisotropic permeability. Classical one-dimensional consolidation theory; the use of consolidation theory to analyze and interpret laboratory and field tests; analysis and design considerations. Extended theories of consolidation, nonlinear finite strain, Biot's consolidation theory, and generalized consolidation theory.

INCI 6335. GRADUATE SEMINAR (BD). One credit hour. One hour of seminar per week.

Presentations and discussions in the areas of graduate studies and research. Faculty members, graduate students, and visiting lecturers will participate in this course.

INCI 6555. STORMWATER RUNOFF MANAGEMENT. Three credit hours. Three hours of lecture per week. Prerequisite: Authorization of the Director of the Department.

Study of the hydrologic, environmental, and economic aspects of stormwater runoff management systems design. Volume determination for the design, study of quality and pollutant loading, and treatment of this stormwater runoff. Design of swales and detention ponds, financial planning of stormwater management systems, and rural area storm water management.

INCI 6995. SPECIAL PROBLEMS (I, II). One to six credit hours.

Research and special problems in Civil Engineering.

INCI 6996. PRACTICE IN CIVIL ENGINEERING. Zero to three credit hours. Zero to three hours of internship per week.

Practical experience in civil engineering jointly planned between the department and the collaborating organization.

INCI 6997. SPECIAL TOPICS. One to six credit hours. One to six hours of lecture per week.

Special topics in Civil Engineering and related areas.

INCI 8024. STRUCTURAL RELIABILITY. Three credit hours. Three hours of lecture per week.

Study of reliability theory and its applications in structural design, risk and sensibility analysis, and code revision. Detailed presentation of level I and level II reliability analysis and an introduction to level III analysis. Discussion of the fundamentals of stochastic processes and load modeling.

INCI 8080. ADVANCED ANALYSIS OF STEEL STRUCTURES. Three credit hours. Three hours of lecture per week.

Study of advanced design theories for steel structures. Analysis of current design specifications for structural members and connections in rigid and semi-rigid frames.

INCI 8999. DOCTORAL RESEARCH AND THESIS. Nine to eighteen credit hours.

Research and presentation of a thesis which constitutes a significant contribution to the field of specialization of the student.

CIVIL ENGINEERING FACULTY

A list of professors who engage in graduate activities in the Department follows, including the highest earned degree, date, and institution granting the degree. Research and teaching interests are also included.

FELIPE J. ACOSTA-COSTA, Professor, Ph.D., 1999, Georgia Institute of Technology. Research interests: Experimental Material Characterization, Construction and Rehabilitation of Structures of Composite Materials. Teaching interest: Finite Element Analysis, Mechanics of Composite Materials, Construction Materials.

LUIS D. APONTE-BERMÚDEZ, Professor, Ph.D., 2006, University of Florida. Research interest: Wind Engineering. Teaching interests: Wind Engineering, Probabilistic Methods.

JUAN B. BERNAL-VERA, Professor, Ph.D., 1984, The University of Texas at Austin. Research interests: Foundations. Teaching interests: Soil Mechanics.

ARSENIO CÁCERES-FERNÁNDEZ, Associate Professor, Ph.D., 1998, West Virginia University. Research interest: Materials for Civil Engineering, Composite Materials Applications and Civil Engineering Infrastructure, Damage Mechanics, Construction Materials made from Recycled Products, Concrete Technology. Teaching interest: Civil Engineering Materials, Composite Materials, and Reinforced Concrete Design.

BEATRIZ I. CAMACHO-PADRÓN, Associate Professor, Ph.D., 2006, University of Texas at Austin. Research interests: Experimental Geotechnics, Geoenvironmental Engineering, Foundation Engineering. Teaching interests: Geoenvironmental Engineering, Foundation Engineering, Environmental Geotechnics, Structural Components in Construction.

BENJAMIN COLUCCI-RIOS, Professor, Ph.D., 1984, Purdue University. Research interests: Pavement Evaluation, Bituminous Materials. Teaching interests: Highway Engineering, Transportation.

IVETTE CRUZADO-VELEZ, Associate Professor, Ph.D., 2009, Pennsylvania State University. Research interests: Transportation Systems Analysis, Public Transportation System, Urban Transportation Planning. Teaching interest: Transportation and Highway Engineering.

ALBERTO M. FIGUEROA-MEDINA, Professor, Ph.D., 2005, Purdue University, Indiana. Research interests: Highway Safety, Urban Transit Systems, Public Transportation System. Teaching interest: Highway Geometric Design, Highway Safety, Highway Engineering, Urban Transit Systems.



APOSTILLE

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2. has been signed by LCDA. MARIA L. VARAS GARCIA
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4. and bears the seal/stamp of CONSEJO DE EDUCACION DE PUERTO RICO
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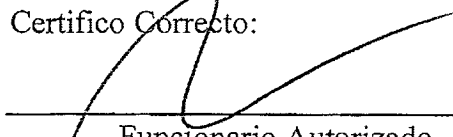
certificado

5. at San Juan, Puerto Rico
en

6. on 19 de junio de 2019
a

7. by Secretario de Estado del Gobierno de Puerto Rico
por

8. No. 90802
bajo el número

Certifico Correcto:

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9. Seal/Stamp
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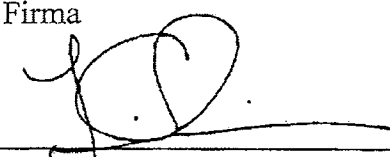
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CANCELADO

10. Signature:
Firma

Luis G. Rivera Marin
Secretario de Estado





GOBIERNO DE PUERTO RICO

Departamento de Estado
Oficina de Registro y licenciamiento de Instituciones de Educación

CERTIFICACIÓN

Yo, María L. Varas García, Directora Interina de la Oficina de Registro y Licenciamiento de Instituciones Postsecundarias (antes Consejo de Educación de Puerto Rico), CERTIFICO:

Que el **Universidad de Puerto Rico, Recinto Universitario de Mayagüez** es una Institución de educación superior pública autorizada por la Junta de Instituciones Postsecundarias para operar en Puerto Rico y ofrecer cursos, conferir grados y credenciales académicas. Entre los programas aprobados está el Doctorado en Filosofía en Ingeniería Civil.

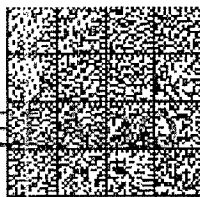
Y para que así conste, expido la presente certificación, en San Juan, Puerto Rico hoy diecinueve de junio de dos mil diecinueve.



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Comprobante



Wilmer Pipicano
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06/19/2019
\$5.00

Licencia Consejo General Educación - Transcripción
E0004-2019-0619-88653145

Lcda. María L. Varas García
Directora Interina

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ACADEMIC RECORD OF
 Number : (502)14-5170
 Social security: ***-**-0000
 Student name : PIPICANO CHICANGANA WILMER
 Place of birth : COLOMBIA
 Date of birth : 01/06/**** Sex: M Clas.: 0580

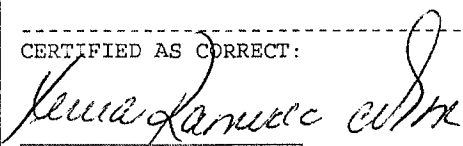
DEGREE OR DIPLOMA ISSUED
 DOCTORADO EN FILOSOFIA EN
 INGENIERIA CIVIL
 GRADUATE 14 DE JUNIO DE 2019

UNIVERSITY OF PUERTO RICO
 MAYAGUEZ CAMPUS
 MAYAGUEZ, PUERTO RICO 00681

OFFICIAL RECORD OF GRADUATE STUDIES

COURSE NUMBER	TITLE	CRDS	GRADE	HONOR	POINTS
1er SEMESTRE 2014-2015					
INCI 6119	ANALISIS DATOS MODELO TRANS	3	A	12	
ININ 6005	ESTADISTI EXPERIMENTALES	3	A	12	
ESMA 6305	METODOS ESTADISTICOS	3	A	12	
INTD 6007	INGL EST INTERNACIONALES	1	P	-	
	** 36 9 4.00 **				
2do SEMESTRE 2014-2015					
INCI 6997	TEMAS ESPECIALES; FACTORES HUMANOS EN LA INGENIERIA DE TRANSPORTACION	3	A	12	
INCI 6048	ANAL SISTEMAS TRANSPORT	3	A	12	
INCI 6077	PLAN Y PROG PROY DE CONSTR	3	B	09	
INCI 6995	PROBLEMAS ESPECIALES; ANALISIS AVANZADO DE SISTEMAS DE AUTOBUSES	3	A	12	
	** 81 21 3.85 **				
1er SEMESTRE 2015-2016					
INCI 6108	ANALISIS DE SEGURIDAD VIAL	3	A	12	
INCI 6051	SIS TRANSPORTE COLECTIVO	3	A	12	
INCI 6050	ANAL AVANZ SISTMS TRANSP	3	A	12	
INCI 8999	INVEST Y TESIS DOCTORAL	0	S	-	
	** 117 30 3.90 **				
EXAMEN CALIFICADOR - APROBADO 02/12/2015					
INCI 8999	2do SEMESTRE 2015-2016 INVEST Y TESIS DOCTORAL	0	S	-	
	** 117 30 3.90 **				
CURSOS ACEPTADOS DE: UNIVERSIDAD DEL CAUCA COLOMBIA PLANREGI ECONTRAN DISEGOM INGETRA1 INGETRA2					
En lugar de:					
INCI 6046	PLANIFIC TRANSPORT URBANA	3	-	-	
INCI 6049	EVAL DE SIST DE TRANSPORT	3	-	-	
INCI 6090	DISEÑO GEOM CARRETERAS	3	-	-	
INCI 5146	INTRO INGENIERIA TRANSITO	3	-	-	
INCI 6047	INGENIERIA DE TRANSITO	3	-	-	
EXAMEN COMPRESIVO - APROBADO 27/05/2016					
INCI 8999	1er SEMESTRE 2016-2017 INVEST Y TESIS DOCTORAL	0	S	-	
	** 117 30 3.90 **				

ADMITTED TO:
 PROGRAMA DOCTORAL EN INGENIERIA CIVIL
 ADMISSION DATE: AGOSTO 2014
 ADMISSION STATUS: TOTAL
 ENTRANCE DEFICIENCIES, IF ANY
 DEGREE HELD
 INGENIERO CIVIL
 FROM
 UNIVERSIDAD DEL CAUCA COLOMBIA
 THESIS
 "DISEÑO DE REDES ESTRUCTURADAS DE TRANSPORTACION COLECTIVA
 INCORPORANDO EN FORMA EXPLICITA LOS BENEFICIOS DEL USUARIO"
 LANGUAGE
 NO REQUERIDO
 FINAL EXAMINATION
 05 DE OCTUBRE DE 2018

REMARKS:
 GRADUATION GRADE POINT AVERAGE: 3.93
 CERTIFIED AS CORRECT:

 REGISTRAR SEAL
 18 de junio de 2019
 DATE
 NOT VALID WITHOUT SEAL
 AND SIGNATURE.
 FECHA DE IMPRESION: 2019-06-18

TRANSMITTED BY MAIL ON REVERSE

Number : (502)14-5170

Name : PEPICANO CHICANGANA WILMER

COURSE NUMBER	TITLE	CRDS	GRADE	HONOR POINTS	COURSE NUMBER	TITLE	CRDS	GRADE	HONOR POINTS
INCI 8999	2do SEMESTRE 2016-2017 INVEST Y TESIS DOCTORAL ** 117 30 3.90 **	0	S	-					
EVENTOS DE HURACANES IRMA Y MARIA ANO ACADEMICO 2017-2018									
INCI 8999	1er SEMESTRE 2017-2018 INVEST Y TESIS DOCTORAL ** 117 30 3.90 **	0	S	-					
INCI 8999	2do SEMESTRE 2017-2018 INVEST Y TESIS DOCTORAL ** 117 30 3.90 **	0	S	-					
INCI 8999	1er SEMESTRE 2018-2019 INVEST Y TESIS DOCTORAL ** 189 48 3.93 **	18	A	72					
COMPLETO LOS REQUISITOS ACADEMICOS CONDUCTENTES AL GRADO DE DOCTORADO EN FILOSOFIA EN INGENIERIA CIVIL EN EL 1ER SEMESTRE 2018-2019 - - - - - FIN DEL EXPEDIENTE - - - - -									

REMARKS:

GRADING SYSTEM
UNIT OF INSTRUCTION: ONE CREDIT HOUR COMPRISES ONE HOUR OF LECTURE-DISCUSSION, OR ONE TO TWO HOURS OF SEMINAR OR TWO TO FOUR HOURS OF LABORATORY, LANGUAGE DRILL OR ANY OTHER WORK OF SIMILAR NATURE EACH WEEK DURING THE SEMESTER. (A MINIMUM OF 15 WEEKS PER SEMESTER OR ITS EQUIVALENT DURING THE SUMMER SESSION).

GRADES: A-EXCELLENT (4 HONOR POINTS PER CREDIT) B-GOOD (3HP) C-SATISFACTORY (2HP) D-PASSING BUT DEFICIENT (0HP) F-FAILURE (0HP) P-PASSED (0HP) I-INCOMPLETE (PROVISIONAL GRADE) W-AUTHORIZED WITHDRAWAL S-SATISFACTORY NS-NOT SATISFACTORY.

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DESCRIPCIÓN DE LOS PROGRAMAS

El Departamento de Ingeniería Civil y Agrimensura ofrece cuatro programas graduados: **Maestría en Ciencias en Ingeniería Civil (Plan 1)**, **Maestría en Ingeniería en Ingeniería Civil (Plan 2 y Plan 3)** y **Doctorado en Filosofía**. En los tres programas de Maestría los estudiantes pueden especializarse en las siguientes opciones:

- Ambiental y Recursos de Agua
- Estructuras
- Transportación
- Geotecnia
- Ingeniería y Gerencia de Construcción

El grado de Doctor en Filosofía en Ingeniería Civil se ofrece en las opciones de Estructuras, Ambiental y Transportación. Se espera en el futuro se pueda ofrecer en las restantes áreas de especialidad.

MAESTRÍA EN CIENCIAS EN INGENIERÍA CIVIL - PLAN I

Esta opción requiere treinta (30) créditos (veinticuatro (24) créditos en cursos más seis (6) créditos de tesis). Deberá aprobar un examen oral de defensa de tesis al final de la maestría.

MAESTRÍA EN INGENIERÍA EN INGENIERÍA CIVIL - PLAN II

Esta opción requiere treinta (30) créditos (veintisiete (27) créditos en cursos más tres (3) créditos en proyecto de ingeniería). Deberá aprobar un examen oral de defensa de proyecto al final de la maestría.

MAESTRÍA EN INGENIERÍA –PLAN III (SIN TESIS NI PROYECTO)

Este programa no requiere tesis o proyecto. Está orientado a profesionales que desean especializarse en una de las opciones de interés de ingeniería civil: estructuras, ambiental y recursos de agua (hidrología/hidráulica), transportación, ingeniería y gerencia de construcción y geotecnia. El programa requiere tomar treinta y seis (36) créditos en cursos y aprobar un examen escrito de comprensión en el área de especialidad al finalizar los estudios.

El Plan III requiere lo siguiente: un máximo de 9 créditos de cursos subgraduados avanzados, un mínimo de 27 créditos a nivel graduado, un mínimo de 21 créditos en el área de especialidad, un mínimo de 6 créditos en cursos relacionados a la opción de especialidad, pero fuera de ésta. Cursos dentro del Departamento, en un área distinta a la opción de especialidad, pueden tomarse para satisfacer este requerimiento. Se requiere aprobar un examen escrito final sobre las materias en su área de especialidad.

DOCTORADO

Se ofrece en las opciones de Ingeniería Estructural, Ingeniería en Transportación e Ingeniería Ambiental. El programa tiene los siguientes requisitos académicos: un mínimo de sesenta (60) créditos posterior a sus estudios de bachillerato, no más de nueve (9) créditos podrán ser de nivel 5000, nueve (9) créditos deben ser fuera de su opción de especialización y un máximo de dieciocho (18) créditos corresponden a la tesis doctoral,

Se aceptará un máximo de veinticuatro (24) créditos de estudios graduados de otras instituciones. No más tarde del comienzo de su segundo año de estudios, el estudiante deberá completar satisfactoriamente un examen calificador que incluye un componente escrito y uno oral en el área de especialidad de Ingeniería Civil. Deberá tomar un examen comprensivo de candidatura al terminar sus cursos.

Créditos en transferencia para nuestros programas graduados:

Se permite un máximo de nueve créditos en cursos electivas de nivel 5000, o superior que fueron aprobados con calificación de A o B durante los estudios de bachillerato en la UPR, aunque los cursos se hayan usados para cumplir los requisitos del grado de bachiller. Pueden incluirse cursos graduados convalidados siempre que no se hayan usado para cumplir los requisitos del grado de bachiller. El total de cursos convalidados no puede entrar en conflicto con el requisito de residencia del RUM. No se convalidarán cursos aprobados en otras instituciones durante un período en el que el estudiante se encuentre suspendido en el RUM. No se convalidarán cursos de tesis, proyecto o similares.

REQUISITOS DE ADMISIÓN PARA LOS PROGRAMAS GRADUADOS

Los requisitos mínimos para entrar a los programas graduados son los siguientes:

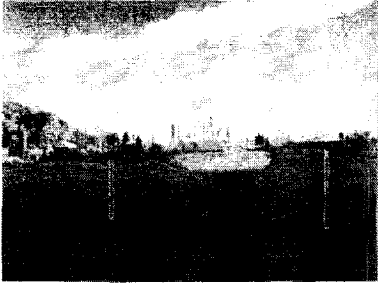
- Tener un índice académico de graduación mayor o igual a 2.50/4.00, o tener un índice académico de especialidad mayor o igual a 3.00/4.00, o haber aprobado en los últimos cuatro semestres de estudio de Bachillerato un mínimo de sesenta (60) créditos con un índice académico mayor o igual a 3.00/4.00.
- Ser evaluado y recomendado por el Comité Graduado Departamental y el Director de Departamento.
- Radicar la solicitud de admisión completa. Se requiere acompañar la solicitud de admisión con tres cartas de recomendación de personas que hayan evaluado su desempeño académico. Debe someter el expediente académico oficial y una certificación de conducta del Decano de Estudiantes de su Institución.

Tiempo para obtener los grados y promedios

La duración mínima requerida para completar los cursos requisitos para el grado de Maestría consiste en tres (3) semestres. La duración máxima permitida para obtener el grado es de seis años. La duración normal es de cuatro (4) años y medio posterior a haber completado el grado de Bachiller en Ciencias en Ingeniería Civil. No es requisito una maestría para solicitar admisión al programa.

Los estudiantes de Maestría y Doctorado deben mantener un índice académico no menor de 3.00/4.00.

OPCIONES DE ESTUDIO



Ambiental y Recursos de Agua

La ingeniería ambiental y de recursos de agua es el área de la ingeniería civil que analiza la ocurrencia, distribución, circulación, manejo y uso del agua en la naturaleza y en sistemas construidos por el hombre. Se estudia el acarreo y el control de contaminantes en el agua, en sustancias sólidas y en la atmósfera. Vela por la protección de la salud pública, el cuidado del ambiente y la reducción de riesgos causados por la naturaleza y por el hombre. Incluye el suministro de agua potable, el manejo de desperdicios líquidos, la protección de los recursos de agua (ríos, lagos, océanos, costas, aguas subterráneas y otros), el control de inundaciones, el diseño de drenajes, la construcción de represas, la protección de las costas, la construcción de obras hidráulicas, el transporte de sedimentos, el manejo y disposición de desperdicios sólidos, el tratamiento de desperdicios industriales y la planificación y diseño de las obras de ingeniería necesarias para lograr estos objetivos. Se evalúan sistemas de desarrollo de bajo impacto (LID), obras sustentables y proceso de resiliencia de infraestructura ambiental.



Estructuras

Se analizan y diseñan estructuras para que resistan en forma segura las fuerzas estáticas y dinámicas de la naturaleza que se ejercen sobre ellas. El diseño de estructuras es un proceso matemático bajo el cual se determina la forma y el tamaño de los elementos que forman la estructura. El ingeniero especializado en

estructuras es el que diseña las estructuras para que resistan cargas gravitacionales, vientos huracanados, terremotos, presiones de tierra, impactos, peso de la estructura, agua y otras acciones. Su intervención es imprescindible en el diseño de viviendas, comercios, industria, puentes, estructuras marinas, aviones, barcos, infraestructura pública y otros, para que estos sean seguros y a la vez económicos. Las estructuras deben resistir huracanes y terremotos.



Geotecnia

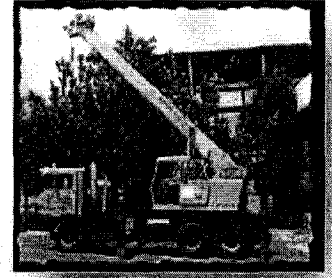
Se analizan y diseñan los soportes para apoyar estructuras en el terreno. Se analizan y diseñan fundaciones para edificios, puentes, muros, torres, plataformas marinas, represas, carreteras, canales, túneles y pistas aéreas. También se analiza la interacción del suelo con el agua y sus procesos de drenaje. Se considera el uso del suelo y las rocas como materiales de construcción. Se evalúan las propiedades mecánicas de los suelos y las rocas, tanto en el campo como en el laboratorio. Se evalúan deslizamientos de terrenos, estabilidad de los suelos y comportamiento de la interacción del suelo y las estructuras.



Ingeniería y Gerencia de Construcción



El ingeniero con preparación en gerencia de construcción está capacitado para administrar proyectos complejos de construcción. El programa de gerencia de construcción incluye gerencia financiera, control de costos, contabilidad, herramientas matemáticas para tomar decisiones, estimado de costos, equipo, mano de obra, materiales, finanzas, seguridad y otros temas. El ingeniero utiliza las computadoras como una herramienta de apoyo para la toma de decisiones y administración más eficientemente. Se planifica el desarrollo de una obra desde su concepción, análisis, diseño, identificación, operación, mantenimiento, rehabilitación y disposición final.



Transportación



Se analiza el movimiento de personas, materiales, objetos y artículos de consumo de una manera segura, rápida, económica y eficiente. Se atienden problemas de disponibilidad de medios de transportación, congestión vehicular, seguridad vial, operación de sistemas de semáforos, señalización, infraestructuras de carreteras, trenes, aeropuertos, estacionamientos y puertos. El ingeniero de transportación está capacitado para planificar, diseñar, construir, operar y mantener todas estas facilidades. Al realizar estos proyectos el ingeniero de transportación utiliza sus conocimientos especializados más su base en física, economías, métodos matemáticos, estadísticas y modelos de simulación de sistemas.



R.R.L.

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Dr. Ricardo R. López, Director Asociado del Programa Graduado
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