

New Curriculum or Curricular Change EFD Template



College of Engineering

Engineering Faculty Document No.:

142-25

February 10, 2025

TO: The Engineering Faculty
FROM: The Faculty of the Lyles School of Civil and Construction Engineering
RE: New Engineering Concentration

The Faculty of the Lyles School of Civil and Construction Engineering has approved the following new Concentration from the College of Engineering. This action is now submitted to the Engineering Faculty with a recommendation for approval.

TITLE:

Master of Science in Civil Engineering

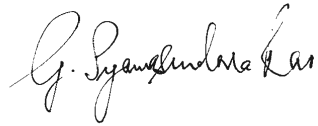
DESCRIPTION:

An interdisciplinary curriculum at the Professional Masters level that will equip professionals with the state-of-the-art knowledge in the contemporary construction topics *Construction Finance, Emerging Tools and Technology in the Built Environment, and Construction Law and Alternative Dispute Resolution (ADR)*. This represents a joint effort between the College of Engineering and the Mitch Daniels School of Business and addresses the contemporary needs in the construction industry.

RATIONALE:

Events in the past decade including the great recession of 2007-2009 and the recent pandemic from 2020-2022 have enhanced the importance of resilience in the construction industry. The need for advanced procedures, means, and methods for construction business management are even more pronounced with the post-pandemic shortage of skilled labor in the industry as well as the supply chain issues faced during the pandemic. To the best of our knowledge none of the existing programs for a Masters in Construction Engineering and Management or MBA in Construction Management/Project Management in the US or around the world offer specialization in the above-mentioned specialties that are at the interface of engineering and business management. The proposed program will allow engineering majors to acquire relevant business management knowledge and business majors to acquire relevant technical knowledge while getting exposed to the state of the art in their specialty areas. Our initial discussion with industry leaders in Indianapolis representing significant stakeholder groups such as CFMA (Construction Financial Management Association) Central Indiana Chapter, CMAA (Construction Management Association of America) Indiana Chapter as well as other industry leaders has indicated strong support and need for such a program. This proposal will include letters of support from these and other industry leaders. The enthusiastic and positive reaction received from these representative stakeholders indicates that the

proposed program aligns well with the current needs and priorities of the construction industry.



Head/Director of the Lyles School of Civil and Construction Engineering

Link to Curriculog entry:

[Paste link to Curriculog entry.]

Proposal
Master of Science in Civil Engineering
Concentration: *Construction Engineering and Business*

The Program Leaders: TBD

Program Chair: TBD

Curricula Type (degree, major, certificate, concentration): Master of Science in Civil Engineering with a concentration in Construction Engineering and Business

Level: Graduate, Professional Masters Program

Campus: Purdue Indianapolis

Rationale:

Why is the program needed?

In traditional Construction Engineering and Management programs at the MS level, many areas of specialties at the interface of Engineering and Business Management do not get adequate attention, e.g.,

- Construction Finance**
- Construction Supply Chain and Logistics
- Construction Informatics
- Emerging Tools and Technology in the Built Environment**
- Construction Business Management
- Construction HR and Labor Relations
- Construction Leadership and Company Management
- Construction Law and Alternative Dispute Resolution (ADR)**
- Other areas such as Sustainability, Resilience, Modular/Factory built Construction, Workforce Transformation, Smart Mobility, Sustainable Water, etc.

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Program objectives:

Therefore the objective of the proposed degree program is to deliver a unique interdisciplinary curriculum at the Professional Masters level that will equip professionals with the state-of-the-art knowledge in the contemporary topics listed above. This represents a joint effort between the College of Engineering and the Mitch Daniels School of Business and addresses the contemporary needs in the construction industry.

The subspecialties listed above are at the interface of Engineering, Business and Law and the anticipated curriculum would provide students with the desired knowledge through core and elective courses in engineering and business that students can tailor to meet their specific professional goals.

How does the program take advantage of opportunities in Indianapolis?

Indianapolis as the state capital has the presence of a large number of companies that represent various segments of the construction industry including commercial, heavy civil, industrial, environmental, as well as housing and real estate that address the facility needs of various industries/clients in the region. The urban environment of Indianapolis is an ideal location to offer a Masters Program targeted towards construction professionals that represent contractors, owners, vendors and the government sector. Some of the large owners requiring construction services include Lilly, Cummins, IU Health, Rolls Royce, Amazon, INDOT, and Simon Property Group. Some of the largest contractors in Indianapolis include AECOM Hunt, F. A. Wilhelm Construction Co, Shiel Sexton, Pepper Construction, Bowen Engineering, The Hagerman Group, BMWC, Messer Construction, etc., to name a few.

What is unique and distinctive about the program?

The program intends to admit students with 3-4 years of professional experience before joining the program. Students will get exposure to the state-of-the-art in practice as well as innovations in their area of specialization. This knowledge when implemented at the company or the project level will result in improved profitability and overall advancement of the industry. The program will have a strong emphasis on experiential learning as explained later. The professors from the College of Engineering and the Daniels School of Business as well as industry experts will teach the required courses. The synergy between engineering and business faculty makes this program unique and adds significant value for the students. Some of the key aspects that make this program unique include:

1. State of the art knowledge in Business Management
2. State of the art knowledge in Construction Engineering
3. Specialties offered at the interface of Engineering and Business
4. Embedded experiential learning.

Scope:

To create pathways in Indianapolis for Construction Industry professionals/students to gain knowledge in their subspecialty that is at the interface of Engineering and Business leading towards a graduate certificate, badge, or a full Professional Masters. In the initial phase three subspecialties would be offered to include:

- a. Construction Finance
- b. Emerging Tools and Technology in the Built Environment
- c. Construction Law and Alternative Dispute Resolution (ADR)

Audience:

The target audience is from the Construction Industry at large including students and working professionals at different stages of their career including C-Suite Executives.

The program will include a combination of in person and online courses with a strong emphasis on experiential learning (explained later). We anticipate the student cohorts to include: (a) part-time working professionals and (b) full time students.

The program would be open to individuals with a BS degree in Engineering, Architecture, Business or Law with 3-4 years of professional experience in the construction industry. The target audience would include domestic as well as international students as either full time, part-time, or online students. We anticipate the domestic (as well as international) students to include working professionals representing construction companies, owner organizations, government entities, vendors, real estate companies, etc.

- (a) The program planning and delivery will consider the time constraints faced by working professionals by offering in-person and online classes. It is the intention to include a purely online program in the near future with a requirement to engage on campus for a certain minimum period of time. Class schedule, when determined, will consider evening in-person courses based on faculty availability.

International students on campus can only take a limited number of credits online per semester and this combination would be of advantage to both full time in-person students and part-time/online students.
- (b) An experiential component to the curriculum is important to facilitate application of knowledge gained through the courses to practical implications in the industry as well as to learn about the work ethics and the means and methods for the specialty areas.
- (c) Full-time international students would benefit from the experiential component as that would give them exposure to the American company culture and work ethics. Whereas, companies would benefit from incorporating new knowledge in their business.

Curriculum

The subspecialties mentioned earlier have multi-disciplinary underpinnings and would include courses from related disciplines from engineering, business, law, etc. The program subspecialties would require a set of core courses that are specific to that subspecialty and a set of electives that would include additional courses from engineering and business. The curriculum would include business essentials, state of the art courses in Construction Engineering and specialty courses that define the interface between business and engineering. The program will include a combination of online and in-person courses. Most CoE courses will be in-person while DSB will offer most courses online. The program will offer core courses each year with the elective courses spread over the semesters as appropriate.

Experiential learning

As mentioned earlier, embedded experiential learning is one of the differentiating factors for this program. The curriculum will include an experiential learning course (over two semesters) where the student will be either embedded in a sponsor company as an intern for the duration of the course or else work with their current employer with the specific objective of a two-way knowledge transfer from the student to the company and from the company to the student. This is a win-win proposition where the student will bring the advanced knowledge gained through the program courses while the company will provide practical exposure to the student as well as a platform to implement the advanced tools and techniques learned through the program. This can be achieved through (i) embedding a student in a sponsor company as an intern, or (ii) a working professional could approach their own company, with a specific objective to

- (a) understand the functioning of the company and identify areas that could benefit from the advanced tools and techniques that the student has learned through the program. This would be identified with the help of the sponsor company,
- (b) the student after understanding the functional areas that could benefit from the advanced tools and techniques would prepare a proposal that would be approved by the sponsor company and the faculty advisor, and
- (c) the student would then work on the deliverable as proposed and prepare a report and presentation for the sponsor company

Projected faculty/instructors needed to support the program

The LSCCE and DSB faculty will offer the online and in-person/hybrid courses as a joint venture between the CoE and the Business School. The program will leverage, as best as possible, the existing set of courses for delivery in Indianapolis.

The faculty would include a combination of Tenure/Tenure Track faculty, Professors of Practice, Continuing Lecturers, as well as Limited Term Lecturers from the specific segments of the industry as per the curriculum requirements.

Advisory Board

The Industry Advisory Board will represent sponsor companies that agree with the proposed experiential learning model and sponsor two or more of their own employees to the program on a regular basis.

Anticipated careers and first positions

The program alumni would have (a) advancement opportunities within their own companies and (b) ample career opportunities within their areas of subspecialties. Since the admitted students would already have 3-4 years of professional experience, the advanced knowledge gained through the program in the various subspecialties would only make them more marketable. Some of the job title could include Controller, Project Manager, Project Engineer, Project Accountant, Data Analyst, Materials and Supply Chain Manager, Procurement and Contracts Specialist, Project Risk Manager, HR Manager, IT Manager, Construction law and ADR Specialist/Counsel, Manager for Sustainability and Modularization, etc.

Projected AY Start

Spring 2026

Description of Similar Programs at Other Universities:

To the best of our knowledge, the Professional Masters as illustrated in this proposal is unique. The list below identifies programs with some similarities.

- ❑ Arizona State University - Online Master of Legal Studies – Construction Law Emphasis. 30-credit requirement.¹
- ❑ Texas A&M University, School of Law – Master of Legal Studies with emphasis in Real Estate and Construction Law, Policy, and Management. 30-credit requirement. Duration 12 – 24 months.²
- ❑ Kings College London – MSc in Construction Law and Dispute Resolution. Full time and Part time options. In-person course offering. Duration 12 – 24 months³
- ❑ The University of Melbourne, Law School – Master of Construction Law. Full time, in-person course offering. Duration 12 – 24 months⁴
- ❑ The British University in Dubai – Master of Science in Construction Law and Dispute Resolution. 30-credit requirement.⁵

¹ <https://asuonline.asu.edu/online-degree-programs/graduate/construction-law-emphases-mls/> (Last visited 12/3/24)

² <https://www.law.tamu.edu/degrees-programs/mls-degree/real-estate-and-construction-law-policy-and-management.html> (Last visited 12/3/24)

³ <https://www.kcl.ac.uk/study/postgraduate-taught/courses/construction-law-and-dispute-resolution-msc> (Last visited 12/3/24)

⁴ <https://study.unimelb.edu.au/find/courses/graduate/master-of-construction-law/structure/> (Last visited 12/3/24)

⁵ <https://www.buid.ac.ae/programmes/master-degree-in-construction-law-and-dispute-resolution/programme-structure/> (last visited 12/4/24)

Projected Instructional Needs Including Classroom Space, Equipment, and Technology

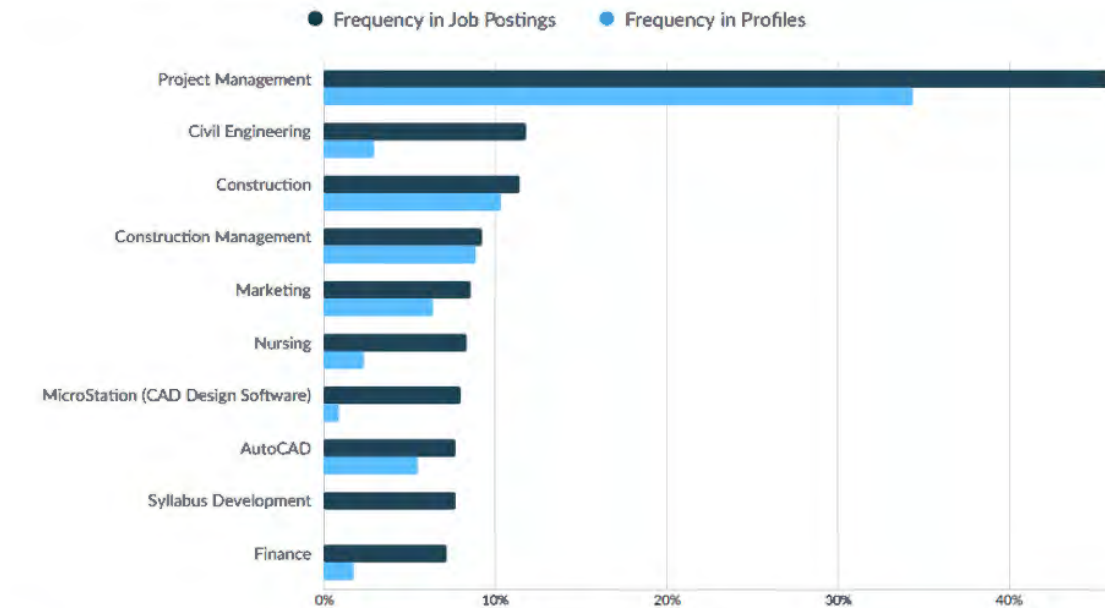
In addition to the classrooms the program will require space for demonstration of emerging tools and technologies. These spaces would include computer lab for software and robotic demonstration as well as outdoor space for larger equipment demonstration.

Tentative Advisory Board (To be individually Confirmed)

- Jeff Hagerman, The Hagerman Group
- Brian Acton, BMW/C
- Ersal Ozdemir, Keystone Group and Indy Eleven
- Messer
- Bowen
- Walsh
- Eli Lilly
- Subaru
- Rolls Royce
- IU Hospitals
- Companies from CMAA membership
- Companies from CFMA membership
- CAT
- John Deere
- INDOT
- Others

Market Studies

Top Specialized Skills

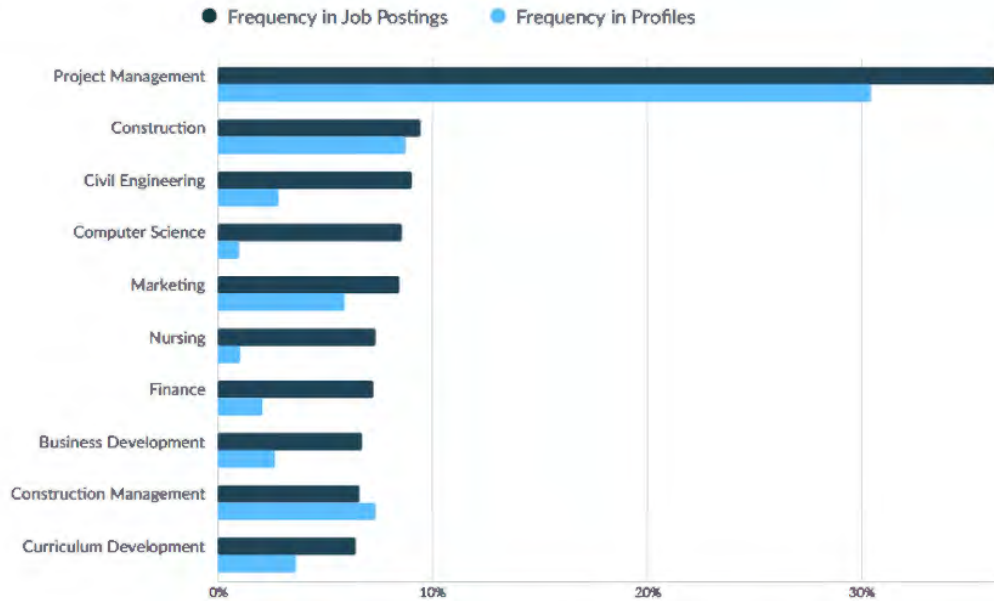


Skills	Postings	% of Total Postings	Profiles	% of Total Profiles	Projected Skill Growth	Skill Growth Relative to Market
Project Management	1,344	46%	10,790	34%	+19.8%	Rapidly Growing
Civil Engineering	346	12%	916	3%	+26.2%	Rapidly Growing
Construction	336	11%	3,244	10%	+10.5%	Growing
Construction Management	272	9%	2,793	9%	+18.4%	Growing
Marketing	252	9%	1,993	6%	+23.0%	Rapidly Growing
Nursing	245	8%	746	2%	+20.1%	Rapidly Growing
MicroStation (CAD Design Software)	234	8%	265	1%	+3.7%	Lagging
AutoCAD	226	8%	1,737	6%	+16.9%	Growing
Syllabus Development	225	8%	0	0%	+21.6%	Rapidly Growing
Finance	210	7%	563	2%	+27.3%	Rapidly Growing

Region: Indianapolis-Carmel-Anderson, Indiana⁶

⁶ Lightcast Q3 2024 Data Set, August 2024 for Indianapolis-Carmel-Anderson, IN

Top Specialized Skills



Skills	Postings	% of Total Postings	Profiles	% of Total Profiles	Projected Skill Growth	Skill Growth Relative to Market
Project Management	179,204	36%	1,338,904	30%	+19.8%	Rapidly Growing
Construction	46,738	9%	384,516	9%	+10.5%	Growing
Civil Engineering	44,708	9%	124,757	3%	+26.2%	Rapidly Growing
Computer Science	42,509	9%	44,309	1%	+26.8%	Rapidly Growing
Marketing	41,968	8%	261,445	6%	+23.0%	Rapidly Growing
Nursing	36,338	7%	44,932	1%	+20.1%	Rapidly Growing
Finance	35,736	7%	90,644	2%	+27.3%	Rapidly Growing
Business Development	33,331	7%	116,373	3%	+5.5%	Stable
Construction Management	32,618	7%	324,303	7%	+18.4%	Growing
Curriculum Development	31,877	6%	161,183	4%	+14.6%	Growing

Region: United States⁷

⁷ Lightcast Q3 2024 Data Set, August 2024. Region: United States

Masters Degree Requirements - Draft Plan of Study/List of Courses

General Program Requirements: 30 Credits

Core: 12 Credits (6 credits Engineering + 6 credits Business Courses)

Experiential Learning: 6 credits over two semesters

Electives: 12 credits (Engineering + Business courses)

SPECIALTY AREA REQUIREMENTS: General Core (12 credits); Specialty Core (6 credits); Electives (6 credits); Experiential (6 credits)

List of Core Courses (12 Credits)

List of Engineering Core Courses (6 Credits)

- 1 Construction Project Control Systems
- 2 Construction Business Management

COURSE	Credits	Core	Elective	On Line	In Person	Instructor
CE52000	3	X			X	
CE52100	3	X			X	

List of Business Core Courses (6 Credits)

- 3 Accounting for Managers
- 4 Managing Behaviors in Organizations

COURSE	Credits	Core	Elective	On Line	In Person	Instructor
MGMT60000	3	X		X		
OBHR68100	3	X		X		

List of Experiential Learning Courses (6 Credits)

- 1 Professional Practice Graduate Internship

COURSE	Credits	Core	Elective	On Line	In Person	Instructor
ENGR69699	6	X			X	

List of Recommended Elective Courses (Pick 12 Credits)

Construction Finance

- 1 Construction Equipment
- 2 Leadership and Advanced Project Management
- 3 Risk Management in Construction
- 4 Construction Accounting and Finance
- 5 Great Projects in Civil Engineering
- 6 Highway & Bridge Construction
- 7 BUSINESS ELECTIVES

COURSE	Credits	Specialty Core	Elective	On Line	In Person	Instructor
CE52300	3	X			X	
CEM50100	3	X			X	
CE59700	3		X		X	
CEM59700	3		X	X		
CE59700	3		X		X	
CEM59700	3		X	X		
MGMT	3-12		X	X		

Emerging Tools and Technology in the Built Environment

- 1 Computer applications in Construction
- 2 Built Environment Modeling (including BIM)
- 3 Risk Management in Construction
- 4 Construction Accounting and Finance
- 5 Asset Management
- 6 Pipeline Condition Assessment
- 7 BUSINESS ELECTIVES

COURSE	Credits	Specialty Core	Elective	On Line	In Person	Instructor
CE52200	3	X			X	
CE52501	3	X			X	
CE59700	3		X		X	
CEM59700	3		X	X		
CEM59700	3		X	X		
CEM59700	3		X	X		
MGMT	3-12		X	X		

Construction Law and Alternate Dispute Resolution (ADR) - For Future Development

- 1 Risk Management in Construction
- 2 Facilities Engineering and Management
- 3 Construction Law
- 4 Arbitration and Alternate Dispute Resolution
- 5 Temporary Structures
- 6 Great Projects in Civil Engineering
- 7 BUSINESS ELECTIVES

COURSE	Credits	Specialty Core	Elective	On Line	In Person	Instructor
CE59700	3		X		X	
CEM53100	3		X		X	
NEW	3	X			X	
NEW	3	X			X	
CEM59700	3		X		X	
CE59700	3		X		X	
MGMT	3-12		X	X		

NOTE: Permanent Course Numbers will be sought for all 59700 courses in due course of time.

PRELIMINARY LIST OF BUSINESS ELECTIVES (DSB)

Course No.	Course Title	Credits
MGMT 60000	Accounting For Managers	3
MGMT 69000	Adv Corporate Finance	2
ECON 59000	Advanced Programming with Python	2
MGMT 59000	Big Data Analytics in the Cloud	2
MGMT 69000	Change Management	2
MGMT 59000	Consulting Tools and Skills	2
MGMT 57100	Data Mining	2
MGMT 59000	Database and SQL	2
MGMT 59000	Deep Learning	2
MGMT 59000	Digital Marketing	2
ECON 59000	Economic Forecasting	2
ECON 59100	Fin Valuation & Decision Mkg	2
MGMT 59000	Frontiers in AI	1
MGMT 59000	Frontiers in C Suite	1
MGMT 59000	Frontiers in Design	1
MGMT 59000	Frontiers in Energy	1
MGMT 59000	Frontiers in Manufacturing	1
MGMT 65330	HR Strategy	2
MGMT 59000	Intellectual Prprty Strategies	1
MGMT 65420	Leadership	2
OBHR 68100	Managing Behavior In Organiz	2
MGMT 62000	Marketing Management	3
MGMT 65430	Negotiatns In Organztn	2
MGMT 59000	Professional Selling	1
MGMT 56200	Project Management	2
MGMT 57000	Spreadsht Modl & Simul	2
ECON 57600	Statistical & Machine Learning	2
MGMT 56500	Strat Sourcing & Procurement	2
MGMT 66400	Supply Chain Management	2
MGMT 65460	Talent Acquisition	2
MGMT 65470	Talent Management	2
MGMT 59000	Tech Strategy	2
MGMT 59000	Financial Management Essentials	1
MGMT 59000	Accounting for Management Essential	1
MGMT 59000	Marketing Management Essentials	1
MGMT 59000	Strategic Management Essentials	1
MGMT 59000	Operations Management Essentials	1
MGMT 59000	Business Storytelling Essentials	1

The Graduate Certificate Requirements

Purdue Graduate School requires completion of 9 credits towards a letter grade as a minimum to receive a Graduate Certificate. We recommend that a student take two core courses (one from CoE and one from DSB) plus an elective to complete the requirements for a Graduate Certificate. See the Table above for course curriculum.

The Badge Requirements

A student can obtain a Badge by completing a self-paced online course or module. These micro-credentials allow students to master a skillset or a tool and demonstrate their proficiency to acquire the badge.

Tentative Schedule (REVISED)

MS in Civil Engineering

Concentration: *Construction Engineering and Business*

ACTIVITY	2024	2025							2026
	DEC	JAN	FEB	MAR	APR	MAY	SUMMER	FALL	SPRING
A. LSCCE Faculty Review	█	█							
B. ECC Review/Curriculog		█	█						
C. Graduate Council Review			█	█					
D. Provost Review/ICHE Approval				█	█				
E. Marketing and Recruitment					█	█	█	█	
F. LSCCE/CoE Resource Alignment						█	█	█	
G. First Cohort									█

NOTE: Target Dates

1. Grad Council meets on March 13th
2. ECC Review/Curriculog by Feb 1st

Financial Model (TO BE REFINED BY CoE BO)

Table: Projected Enrollment and Estimated Net Revenue

Avg Credits per Student = 4.5 credits/semester (i.e., 9 credits/year)	Estimated Fall Semester Enrollement				
	AY2026	AY2027	AY2028	AY2029	AY2030
Total Students	27	30	40	50	60
Number of 3-credit courses/year	5	6	8	8	8
Number of Instructors	5	6	8	8	8
Gross Revenue (Tuition @ \$1000/credit)	\$243,000	\$270,000	\$360,000	\$450,000	\$540,000
Expenses					
Faculty Salary @ \$10,000/3-credit course	\$50,000	\$60,000	\$80,000	\$80,000	\$80,000
Program Director	\$80,000	\$82,400	\$84,872	\$87,418	\$90,041
Secretarial Support @ 1.0 FTE @\$40,000	\$20,000	\$20,600	\$42,436	\$43,709	\$45,020
Academic Advisor(s) @ 0.5 FTE @\$50,000	\$0	\$0	\$25,000	\$25,750	\$26,523
Benefits @ 35%	\$35,000	\$36,050	\$53,308	\$54,907	\$56,554
Marketing	\$40,000	\$40,000	\$40,000	\$40,000	\$40,000
Misc Operational Expenses	\$10,000	\$10,000	\$10,000	\$10,000	\$10,000
Net Revenue (CoE + DSB)	\$8,000	\$20,950	\$24,384	\$108,216	\$191,862

NOTE

1. Faculty from LSCCE and DSB would offer the courses (LTLs would be added later)
2. Tuition is assumed at \$1000/credit
3. Faculty salary is assumed at \$10,000/3-credit course
4. This estimate would require 26 students for breakeven year-1
5. No Overhead has been considered