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## Research Spotlight

### **2339 - Exploring Credit Loss for Engineering Transfer Students**

Credits and Degree Pathways, Matriculation Trends and Issues

Credit loss can significantly impact transfer students enrolled in highly sequential degrees, such as engineering. Missing one crucial prerequisite course at the time of transfer can extend a student's time to degree by a year or more. Determining what credits transfer in engineering could help ease the transfer process, improve graduation rates, and broaden participation in engineering. This session will examine the multiple kinds of credit loss of engineering transfer students.

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# EXPLORING CREDIT LOSS FOR ENGINEERING TRANSFER STUDENTS

AMY RICHARDSON  
DAVID KNIGHT

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## WHY ENGINEERING STUDENTS?

- Broaden participation
- Engineering degrees are highly sequential/specialized
- Engineering degrees have a high curricular complexity scores





# CREDIT LOSS

# CREDIT LOSS CALCULATIONS

## CREDIT TRANSFERABILITY

Credits earned prior to transfer

–

Credits accepted at the time of transfer.

(Giani, M. S., 2019)

(Monaghan & Attewell, 2015)

(Fink et al., 2018)

## APPLICABILITY OF TRANSFER CREDIT

Accepted Transfer Credit

–

Credits used to meet a Degree Requirement

(Fink et al., 2018)

## EXCESS CREDITS

Total Number of Credits Earned

–

Total Number of Credits Required in the Degree Program

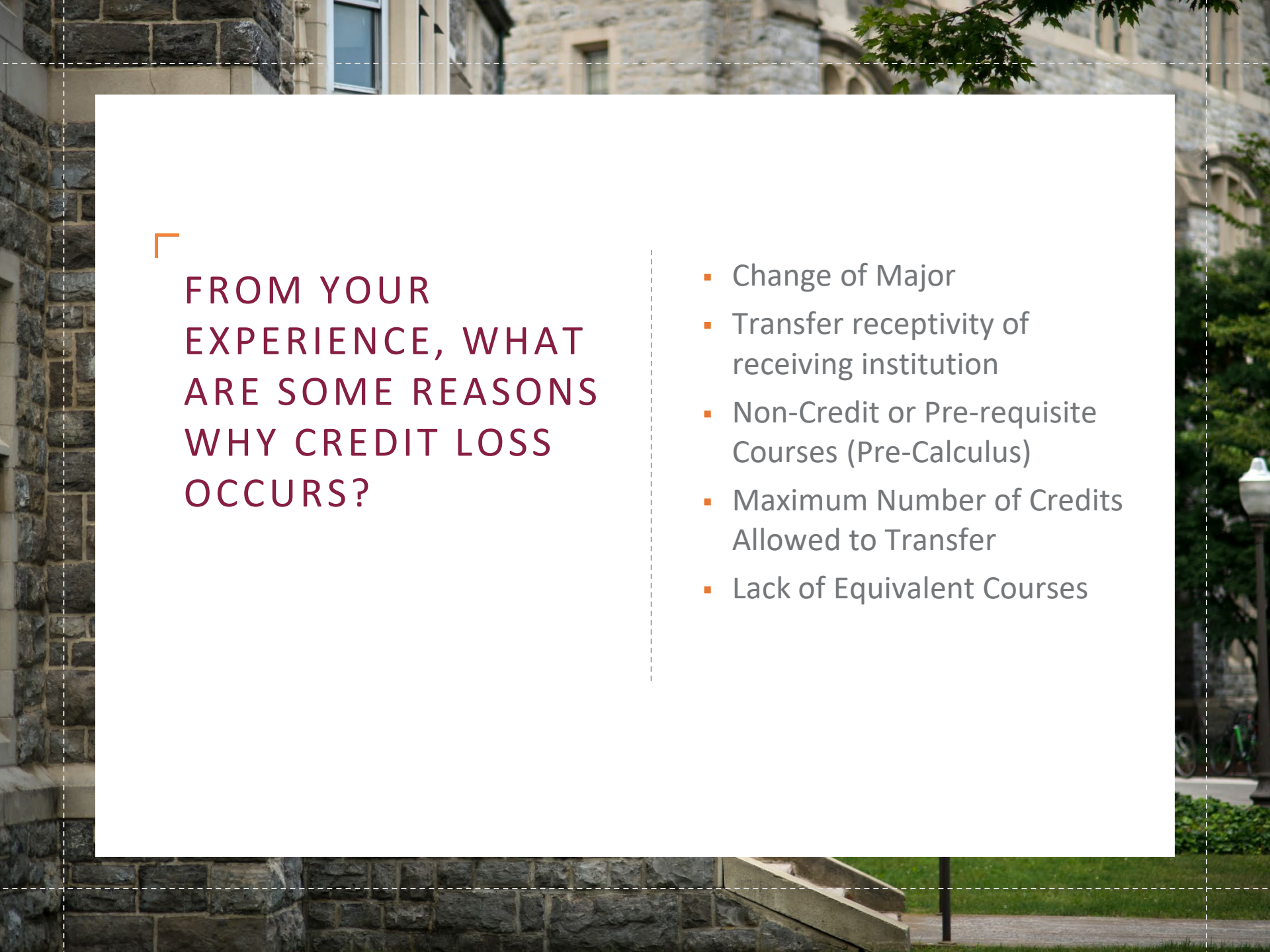
(Fink et al., 2018)



FROM YOUR  
EXPERIENCE, WHAT  
ARE SOME REASONS  
WHY CREDIT LOSS  
OCCURS?





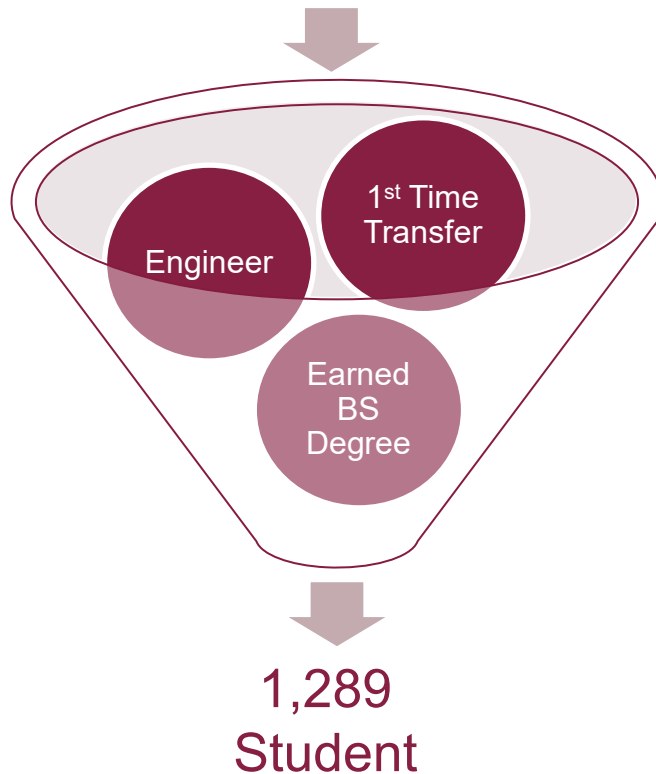


FROM YOUR  
EXPERIENCE, WHAT  
ARE SOME REASONS  
WHY CREDIT LOSS  
OCCURS?

- Change of Major
- Transfer receptivity of receiving institution
- Non-Credit or Pre-requisite Courses (Pre-Calculus)
- Maximum Number of Credits Allowed to Transfer
- Lack of Equivalent Courses

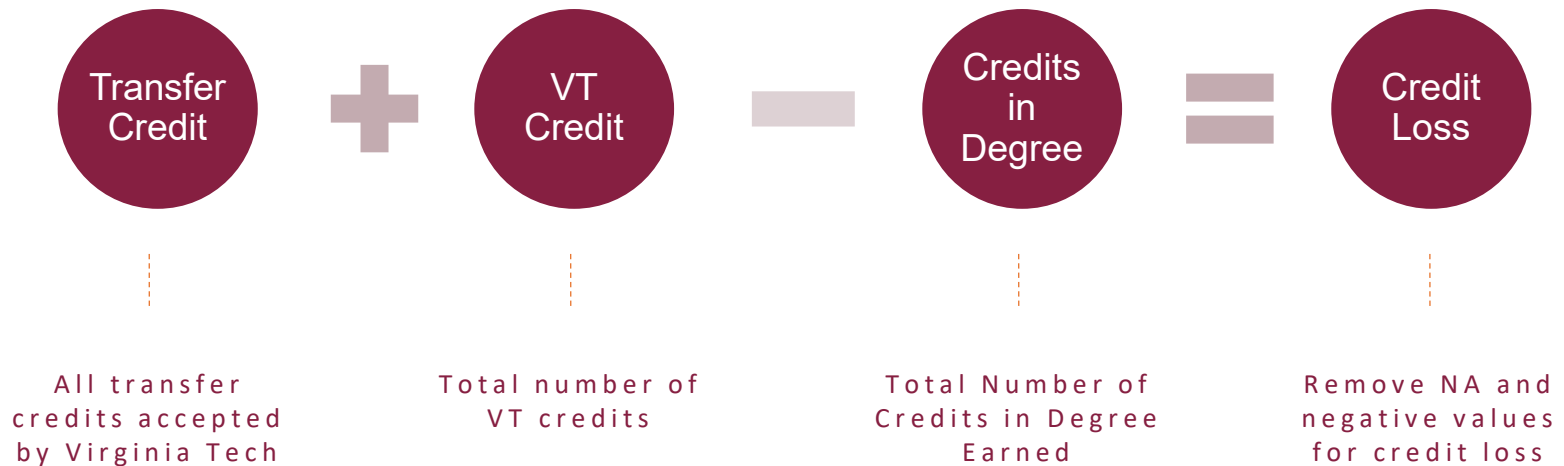


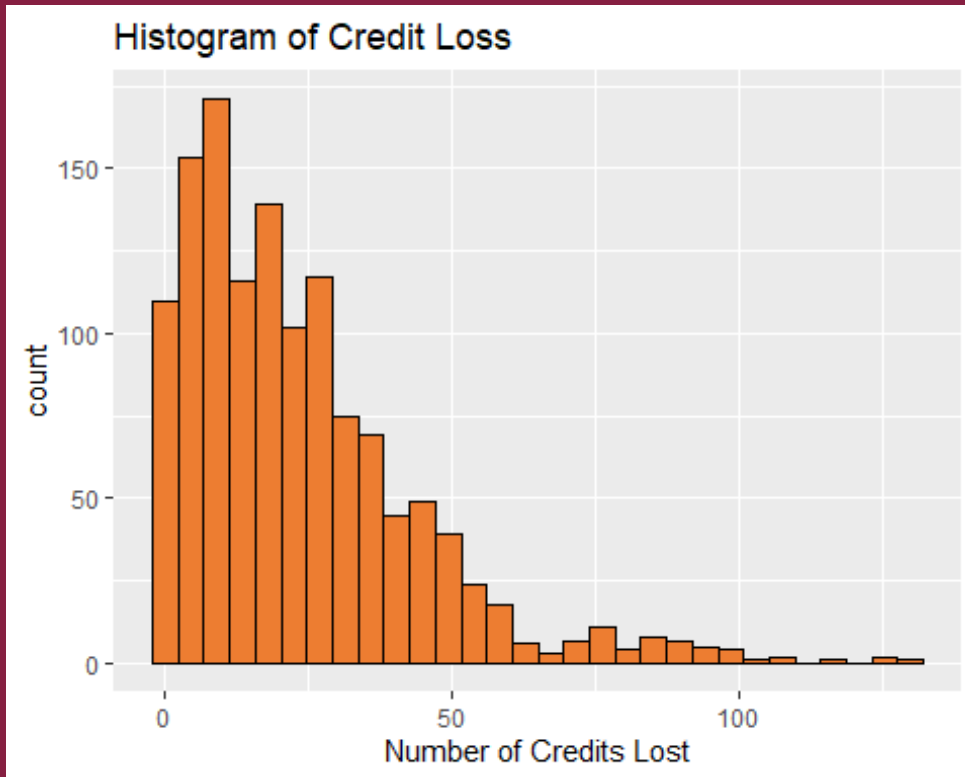
97,905  
Student Observations



- Reduced observations to students with Engineering major
- Filtered 1<sup>st</sup> time transfer students
- Students earn a Bachelor's degree
- Removed double majors
- Identify one transfer institution for each student (assigned the institution with the most credits transferred)

# CREDIT LOSS CALCULATION





## DESCRIPTIVE STATISTICS

n=1289

Mean = 23.44

sd=20.28

Median = 19

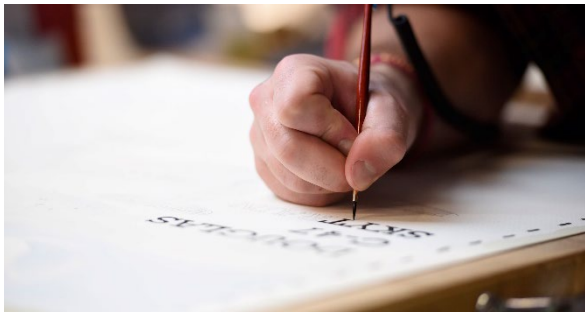
Min = 0

Max = 130

Skew = 1.57

Kurtosis = 3.31

Se = 0.56

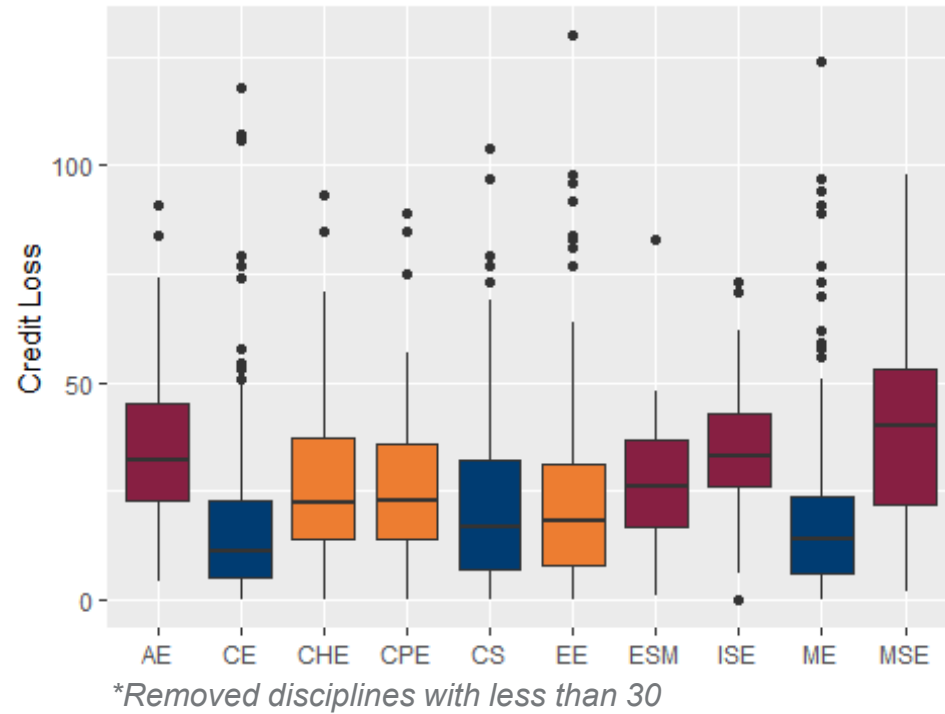


## COLLEGE OF ENGINEERING

- Largest College at VT
- 10,000 UG Students
- 14 Engineering Majors
- 300 transfer/year enrolled

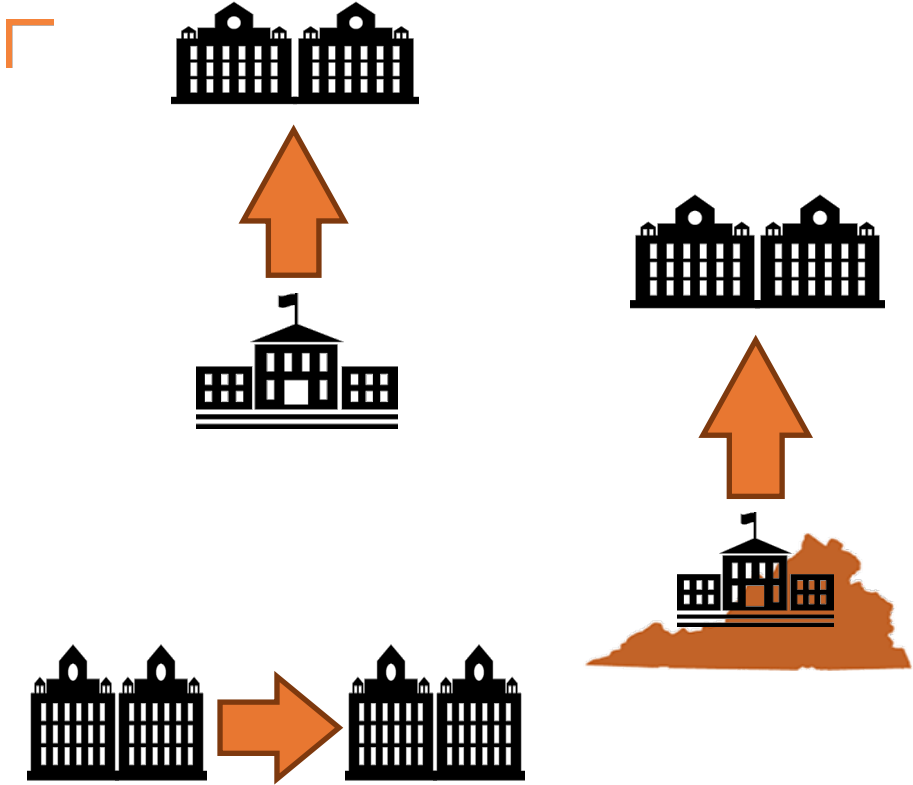


# ENGINEERING DISCIPLINE



Kruskal-Wallis Test concludes that Engineering Major does significantly relate to credit loss

	COUNT	MEAN	MEDIAN
Civil	227	16.778	11
Mechanical	337	17.877	14
Computer Science	125	23.316	17
Electrical	185	22.914	17
Chemical	66	27.417	22.5
Computer	91	26.154	23
Engineering Science & Mechanics	33	27.909	26
Aerospace	73	35.836	32
Industrial Systems	73	34.151	33
Material Science	37	38.703	40



## CREDIT LOSS BY TRANSFER TYPE

### Transfer Institution

- Determined by the institution that transferred in the most credits

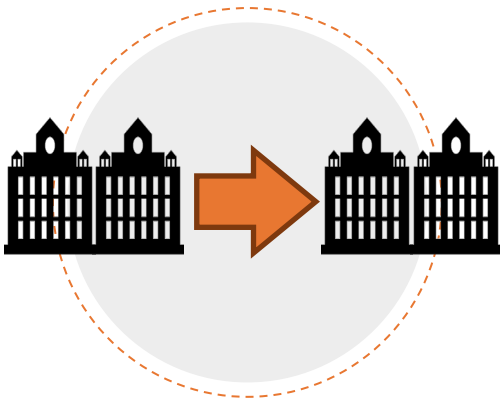
### Total Semester Time to Degree

- Determined by the number of semesters enrolled in VT until degree was earned

### Data Cleaning

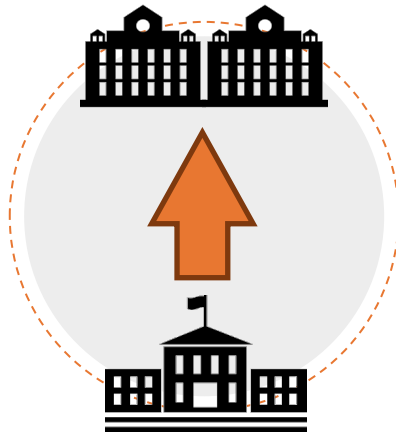
- Removed where transfer institution was NA
- Transient

# TRANSFER TYPES



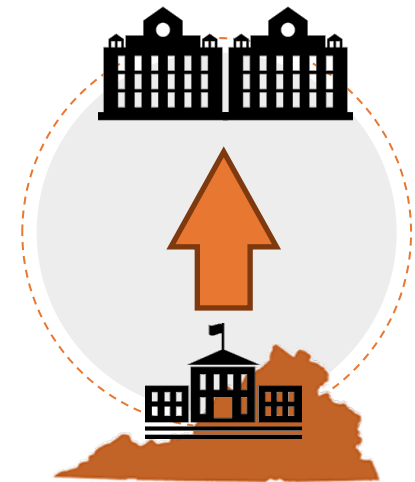
## HORIZONTAL

Transfer from University  
to University



## VERTICAL

Transfer from a  
Community College to a  
University

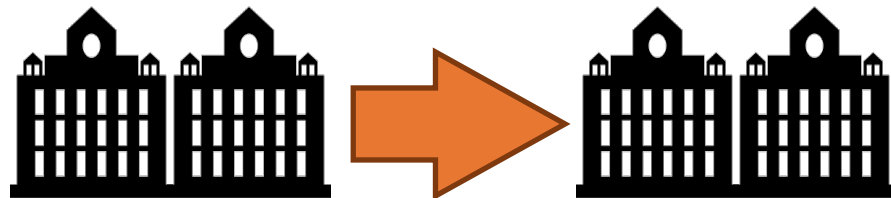
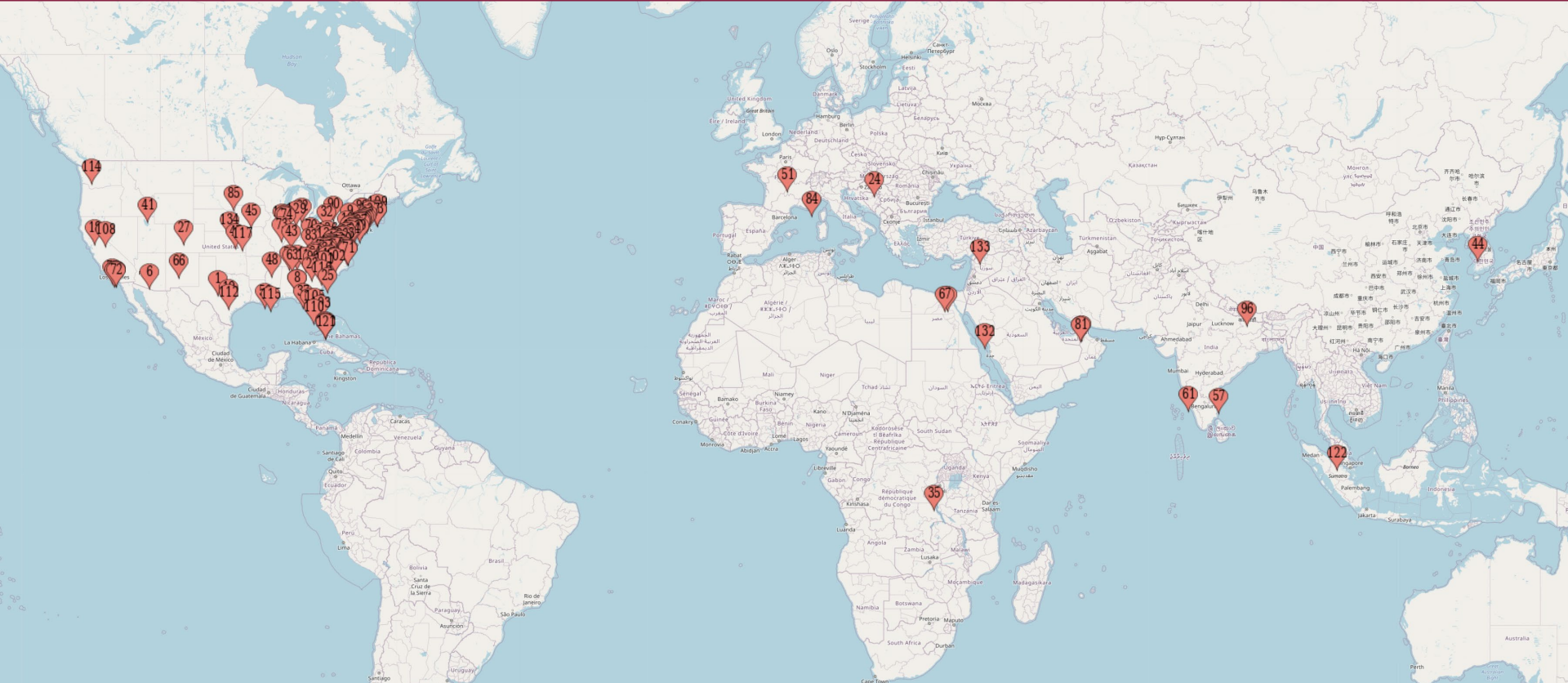


## VERTICAL-VCCS

Transfer from a Virginia  
Community College to a  
University

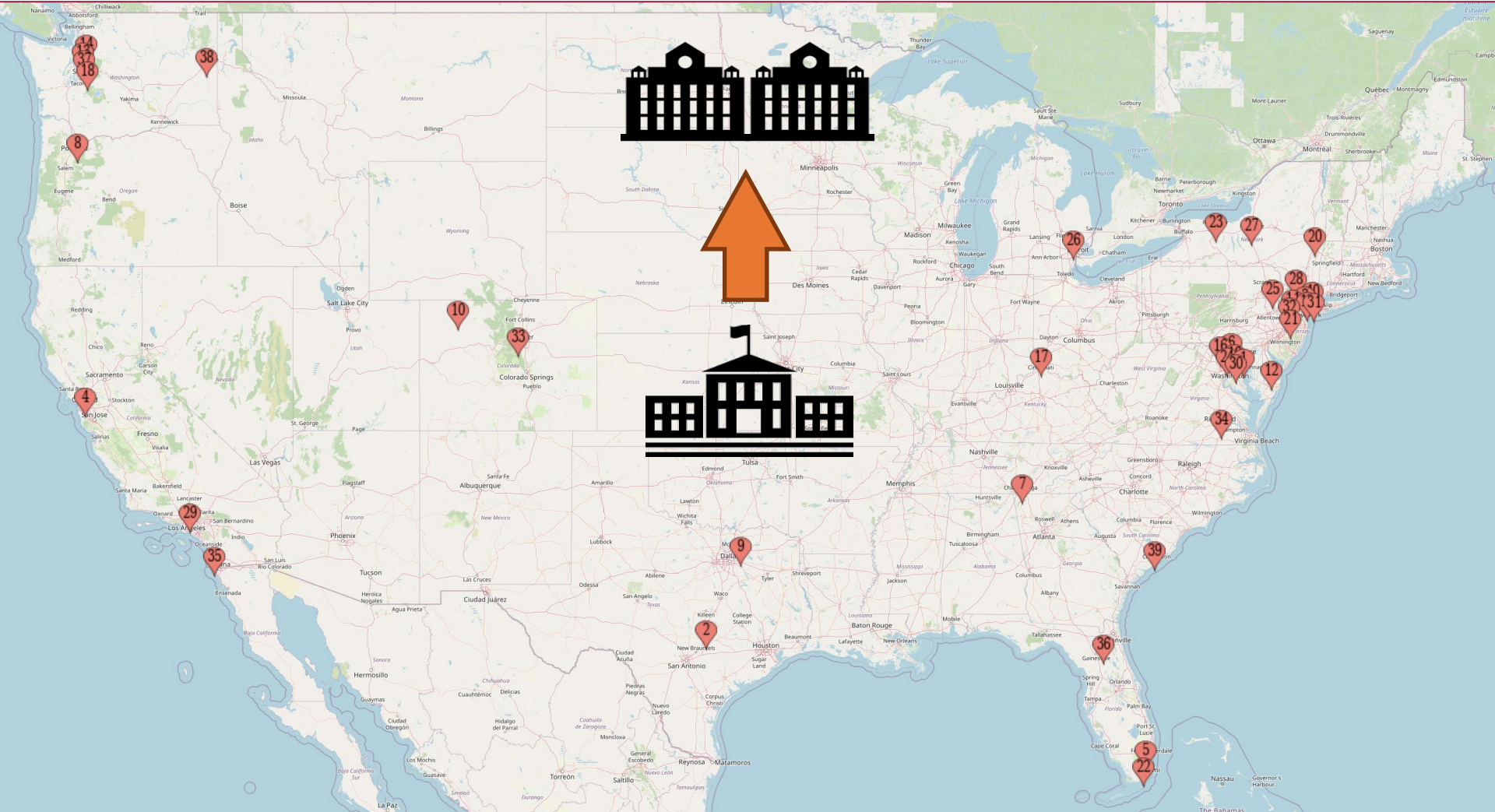


# HORIZONTAL TRANSFER 141 different institutions

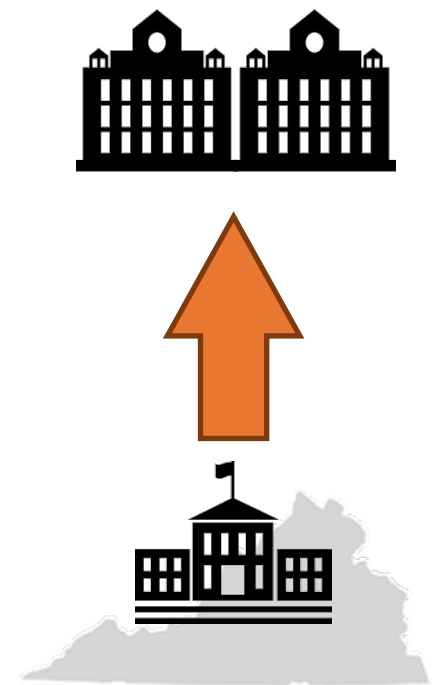
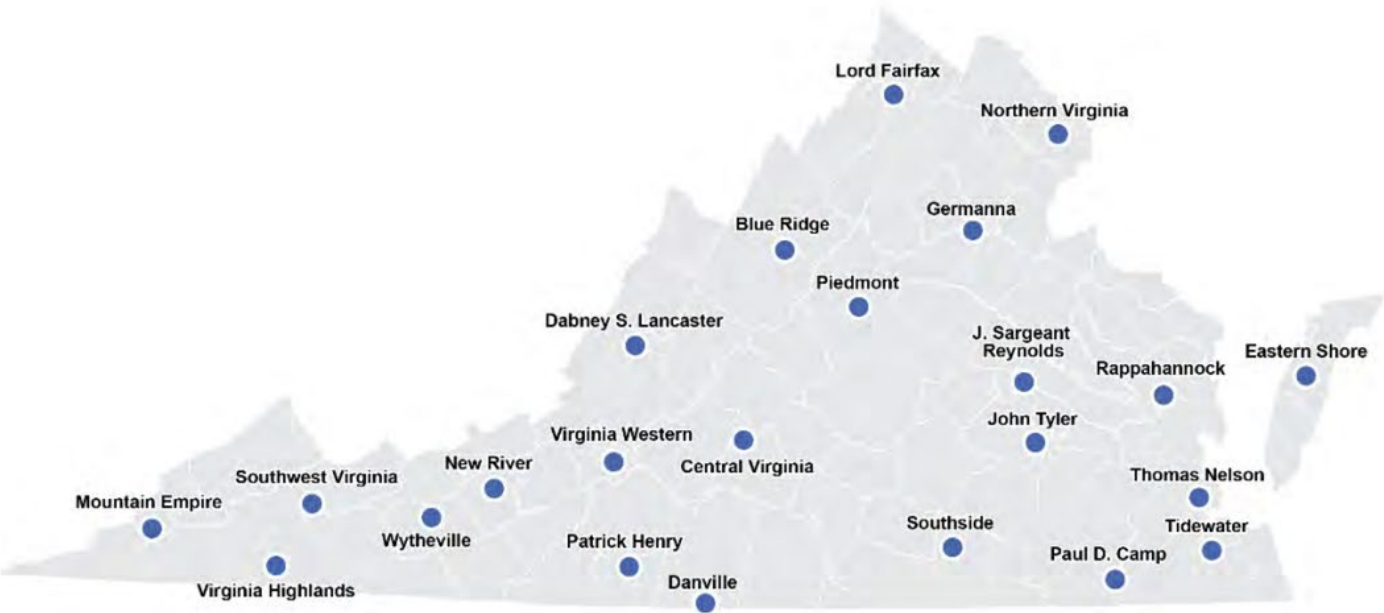




# VERTICAL TRANSFER 40 different institutions

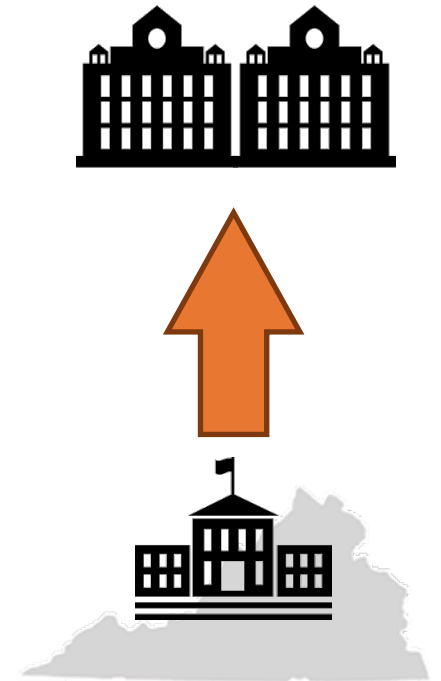


# VERTICAL TRANSFER-VCCCS 23 institutions

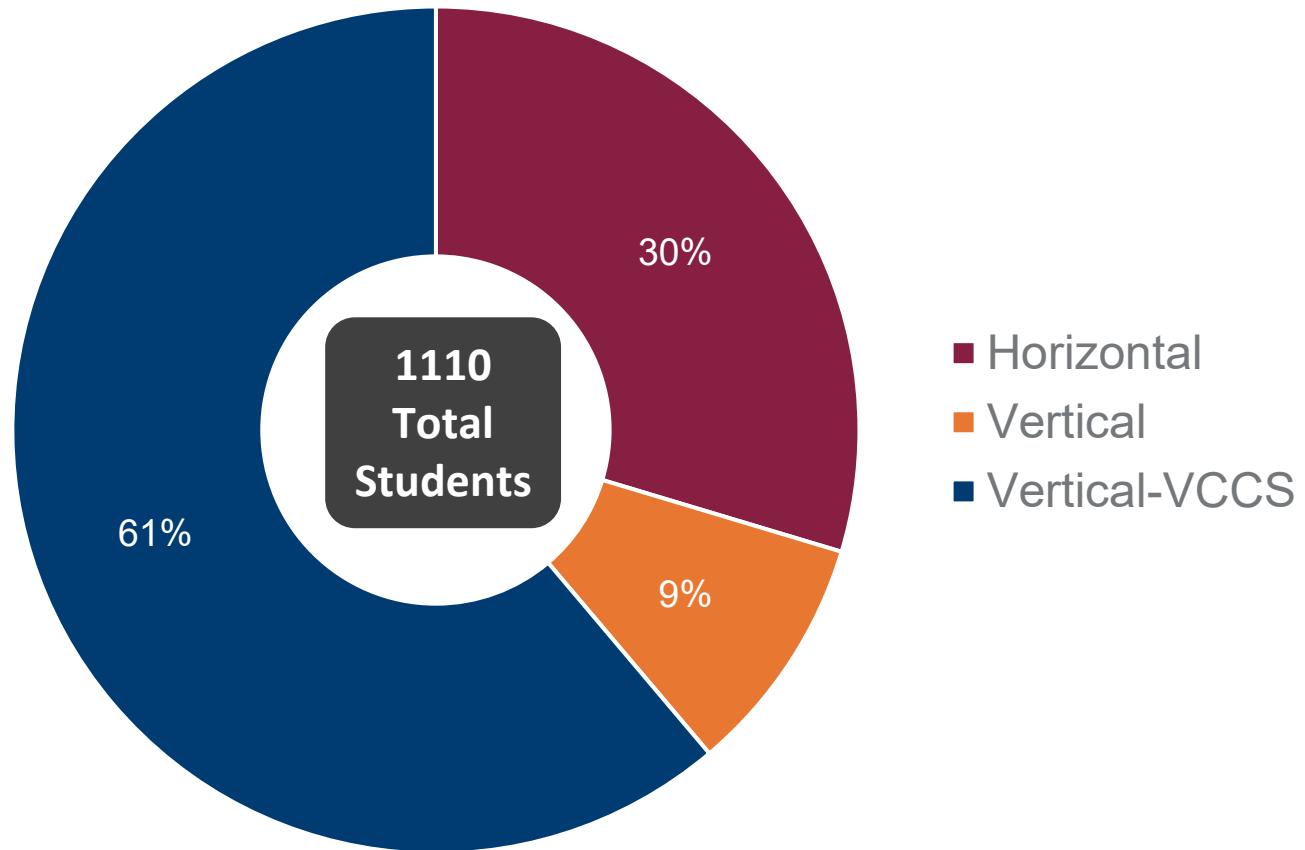


# VERTICAL TRANSFER-VCCCS

- Common course numbering, syllabi, and transfer equivalencies
- Guaranteed Admissions Agreement
  - Earn Engineering, AS degree
  - Minimum 3.2 GPA
- General Education Waiver
  - Students that earned AS degree

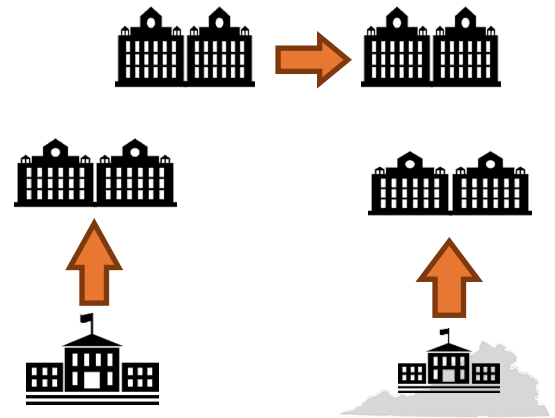
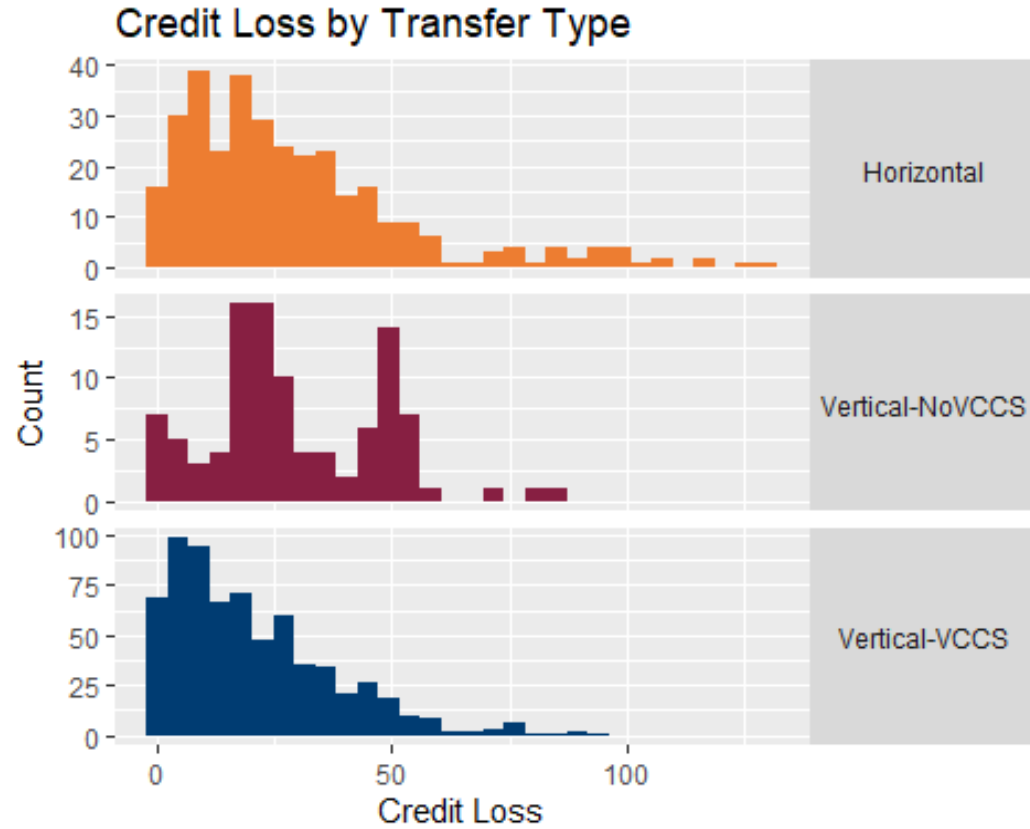


# TRANSFER TYPE DISTRIBUTION



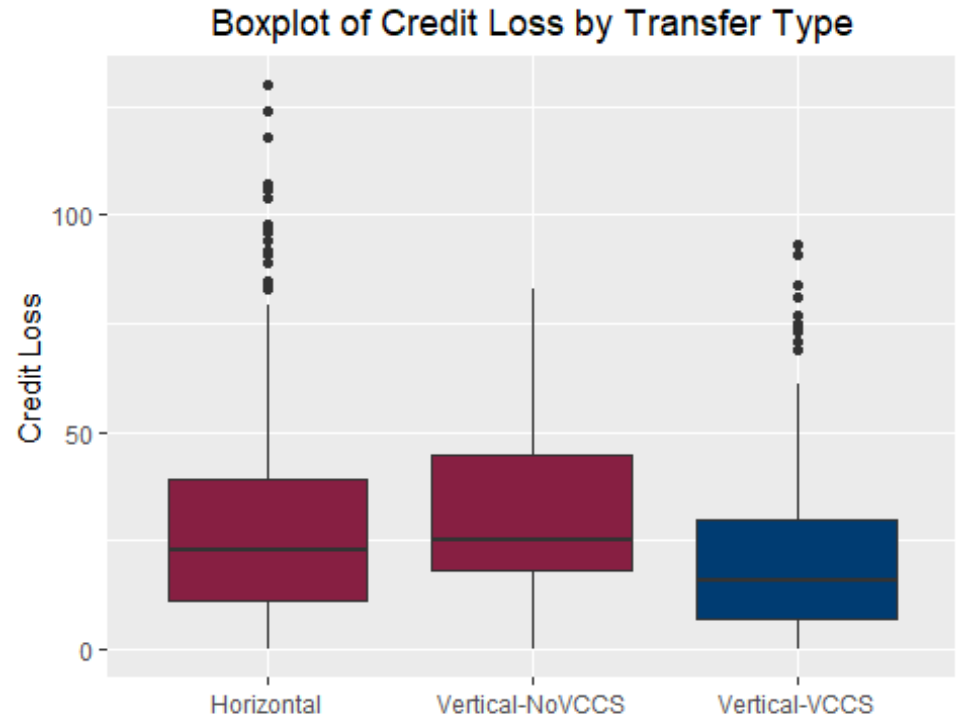


## CREDIT LOSS BY TRANSFER TYPE



## CREDIT LOSS BY TRANSFER TYPE

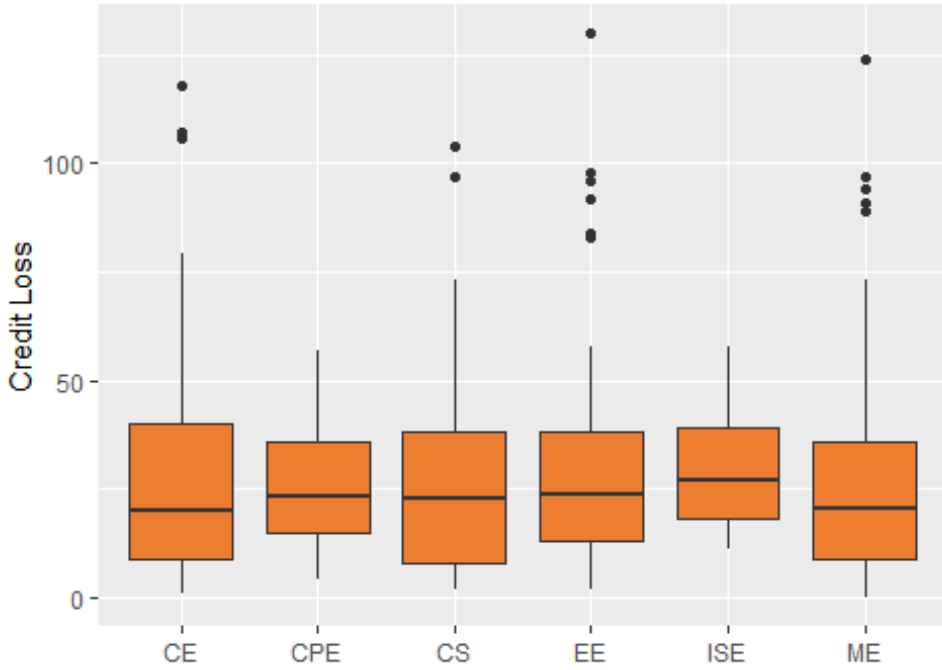
- $p < 0.001$  we reject the null hypothesis and conclude that credit loss differs between transfer types.



	COUNT	MEAN	MEDIAN	MAX	MIN
Horizontal	329	29.40058	23	130	0
Vertical	102	29.57353	25	83	0
VCCS	679	20.49705	16	93	0



# HORIZONTAL - DISCIPLINE



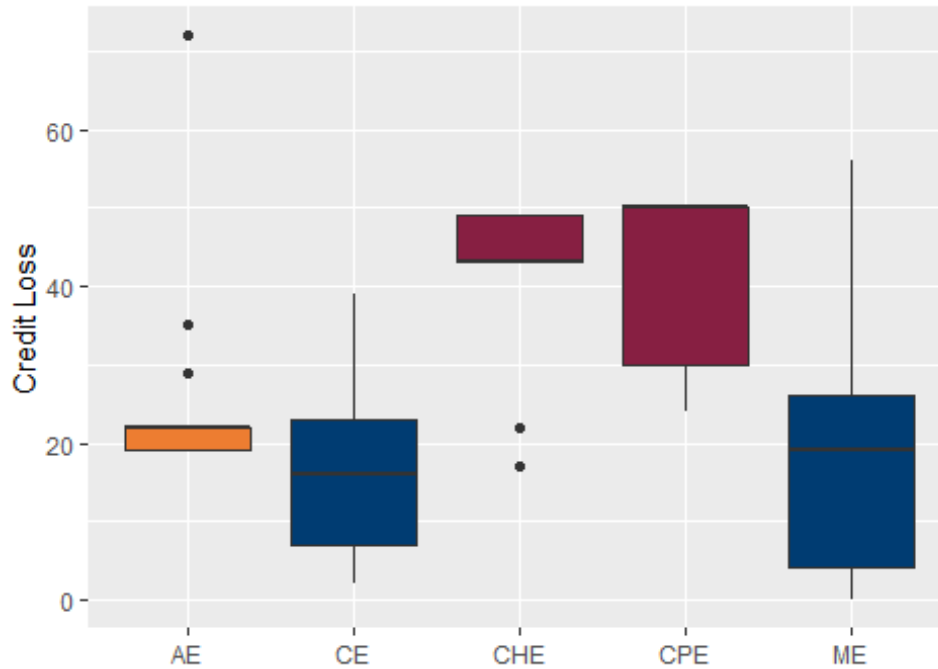
\*Removed disciplines with less than 20

Kruskal-Wallis Test concludes that Engineering Major does **NOT** significantly relate to credit loss for horizontal transfer students

	COUNT	MEAN	MEDIAN
Civil	59	30.208	20
Computer	24	27.458	23.5
Computer Science	29	28.931	23
Electrical	50	31.780	24
Industrial & Systems	25	29.880	27
Mechanical	92	26.516	20.5



# VERTICAL - DISCIPLINE



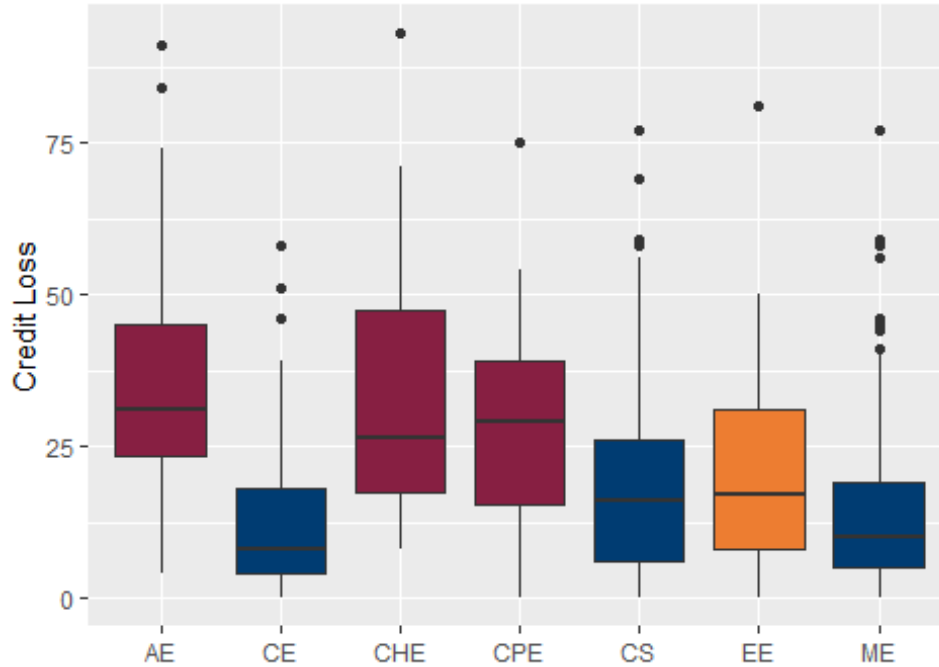
*\*Removed disciplines with less than 10*

Kruskal-Wallis Test concludes that Engineering Major does significantly relate to credit loss for horizontal transfer students

	COUNT	MEAN	MEDIAN
Aerospace	16	25.125	22
Civil	19	17.974	16
Chemical	13	40.154	43
Computer	10	41.600	50
Mechanical	26	18.5	19



# VCCS - DISCIPLINE



*\*Removed disciplines with less than 30*

Kruskal-Wallis Test concludes that Engineering Major does significantly relates to credit loss for horizontal transfer students

	COUNT	MEAN	MEDIAN
Aerospace	42	36.571	31
Civil	132	12.28	8
Chemical	34	33.221	26.5
Computer	55	27.800	29
Computer Science	75	19.827	16
Electrical	102	20.020	17
Mechanical	180	14.356	10

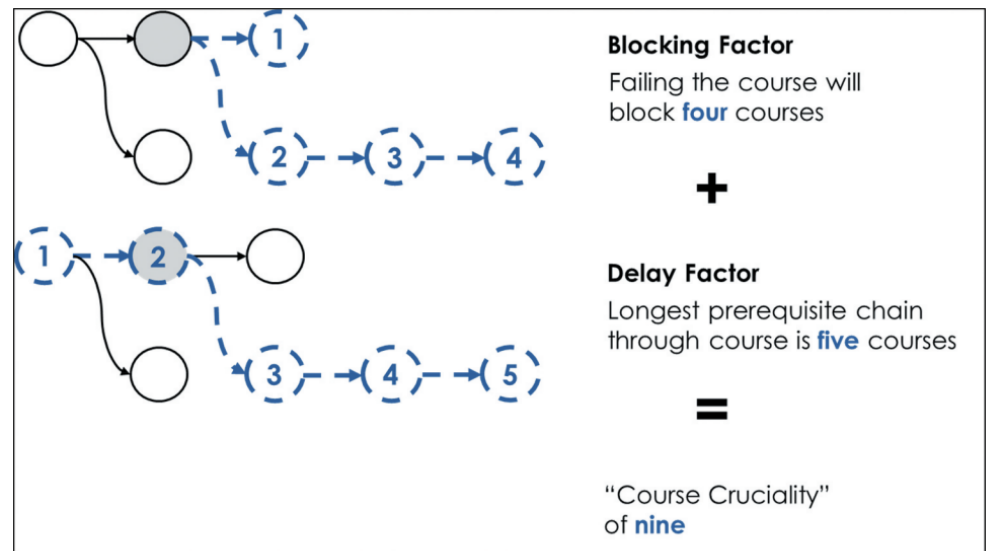
## DIFFERENCES IN DISCIPLINES

- Number of total credits
- Number of key transferrable courses
- Curricular Complexity

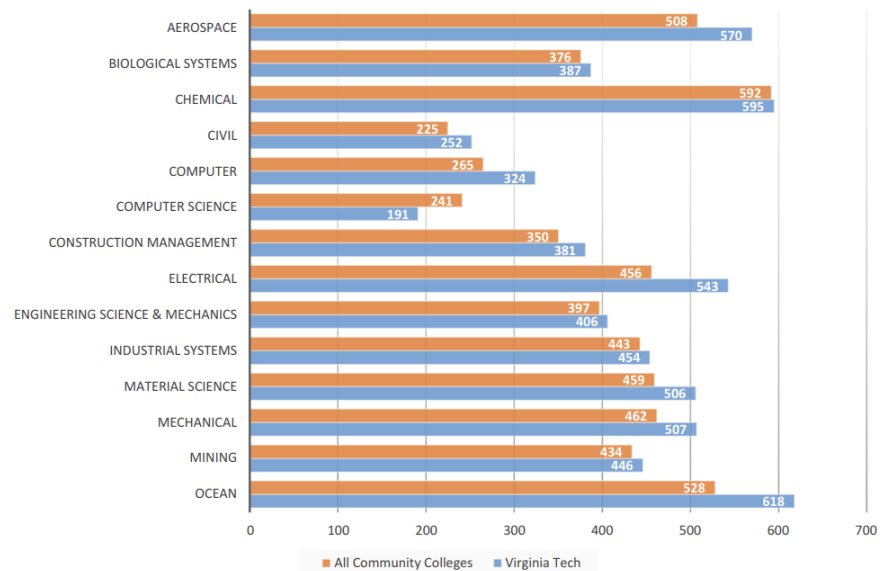
Figures from:

Grote, D., Knight, D. B., Lee, W. C., & Watford, B. A. (2020). Navigating the Curricular Maze: Examining the Complexities of Articulated Pathways for Transfer Students in Engineering. *Community College Journal of Research and Practice*, 1–30.

<https://doi.org/10.1080/10668926.2020.1798303>



**Figure 1.** Visual example of calculating blocking factor, delay factor, and cruciality scores for course.



**Figure 2.** Curricular complexity by engineering discipline for FTIC and transfer pathways.



# CLOSER LOOK AT VCCS

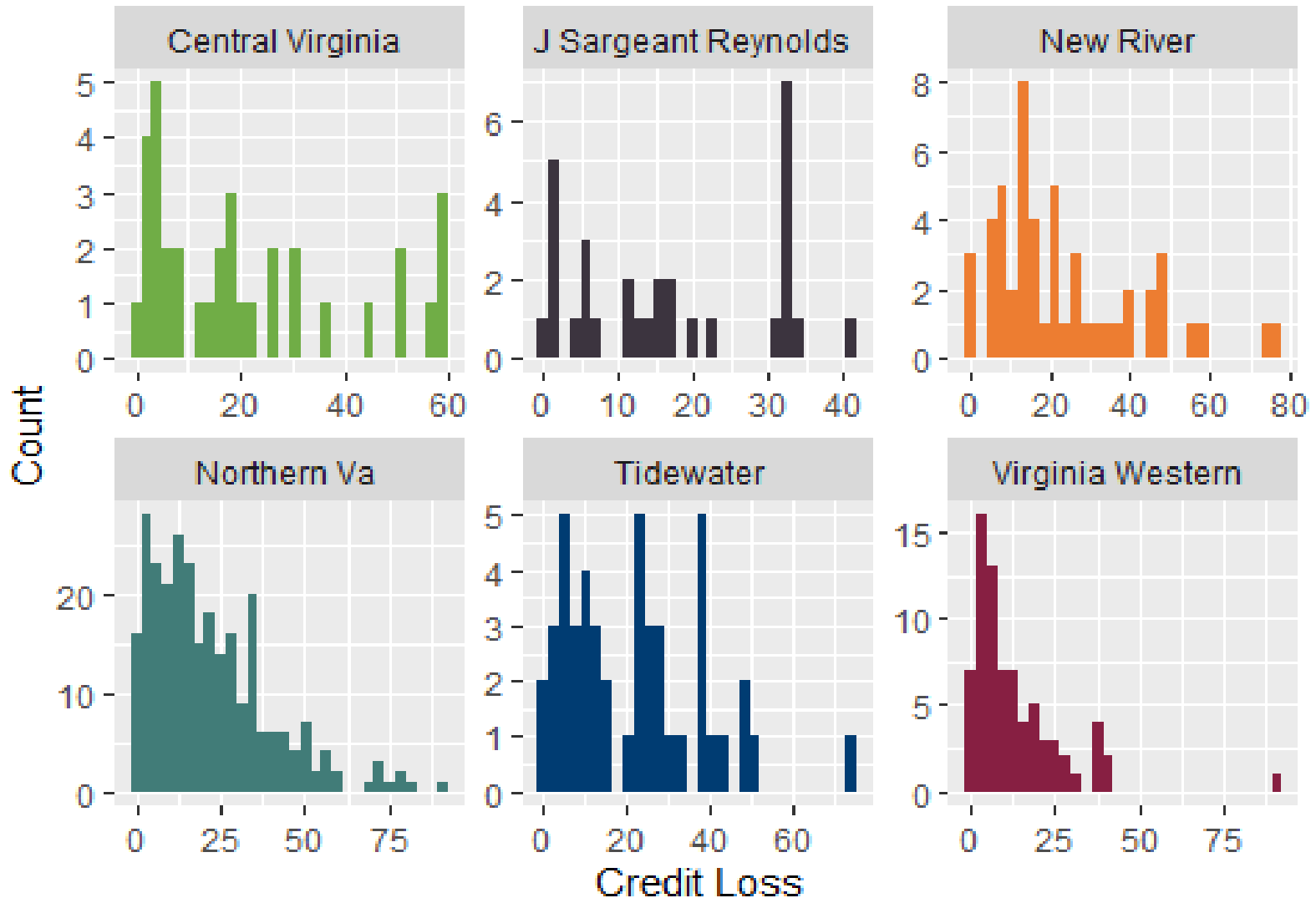
## CLOSER LOOK AT VCCS TRANSFER

Only include schools with  
 $n > 30$

- Central Virginia
- JSargeant Reynolds
- New River
- Northern Virginia
- Tidewater
- Virginia Western

TransInst.Name	n
Blue Ridge ege VA	17
Central Virginia	35
Dabney Lancaster ege	1
Danville	11
Eastern Shore	3
Germanna	25
J Sargeant Reynolds	31
John Tyler	6
Lord Fairfax	18
Mountain Empire ege	1
New River	51
Northern Va	275
Northern Virginia Comm Coll	1
Patrick Henry	4
Piedmont Virginia ege	23
Rappahannock	2
Southside VA Alberta	1
Southwest Virginia	18
Thomas Nelson	21
Tidewater	47
Virginia Highlands	8
Virginia Western	75
Wytheville	5

# Histogram of Number of Credit Loss

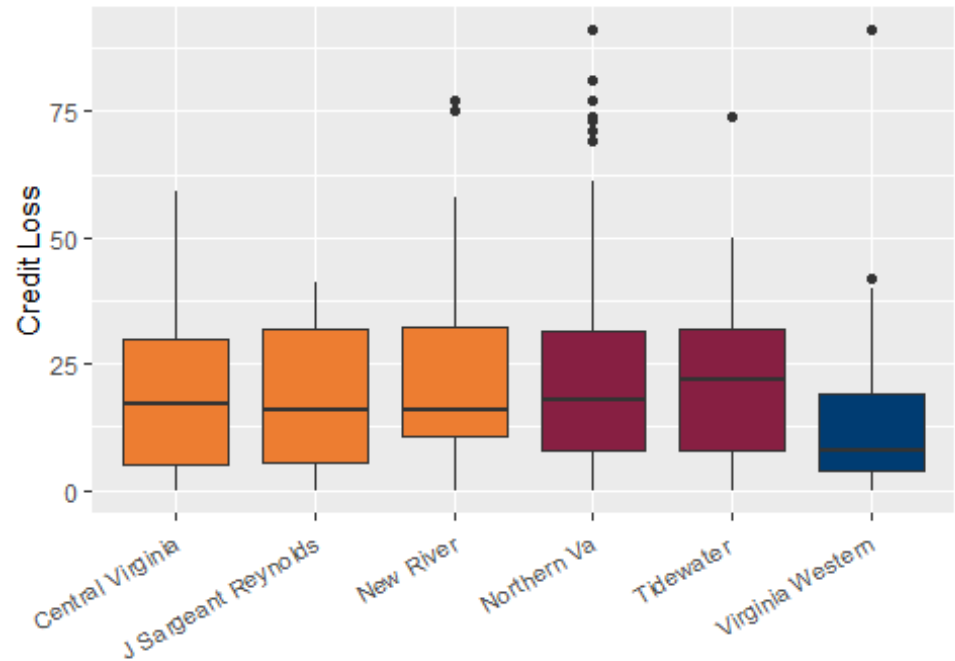




## CREDIT LOSS BY VCCS INSTITUTION

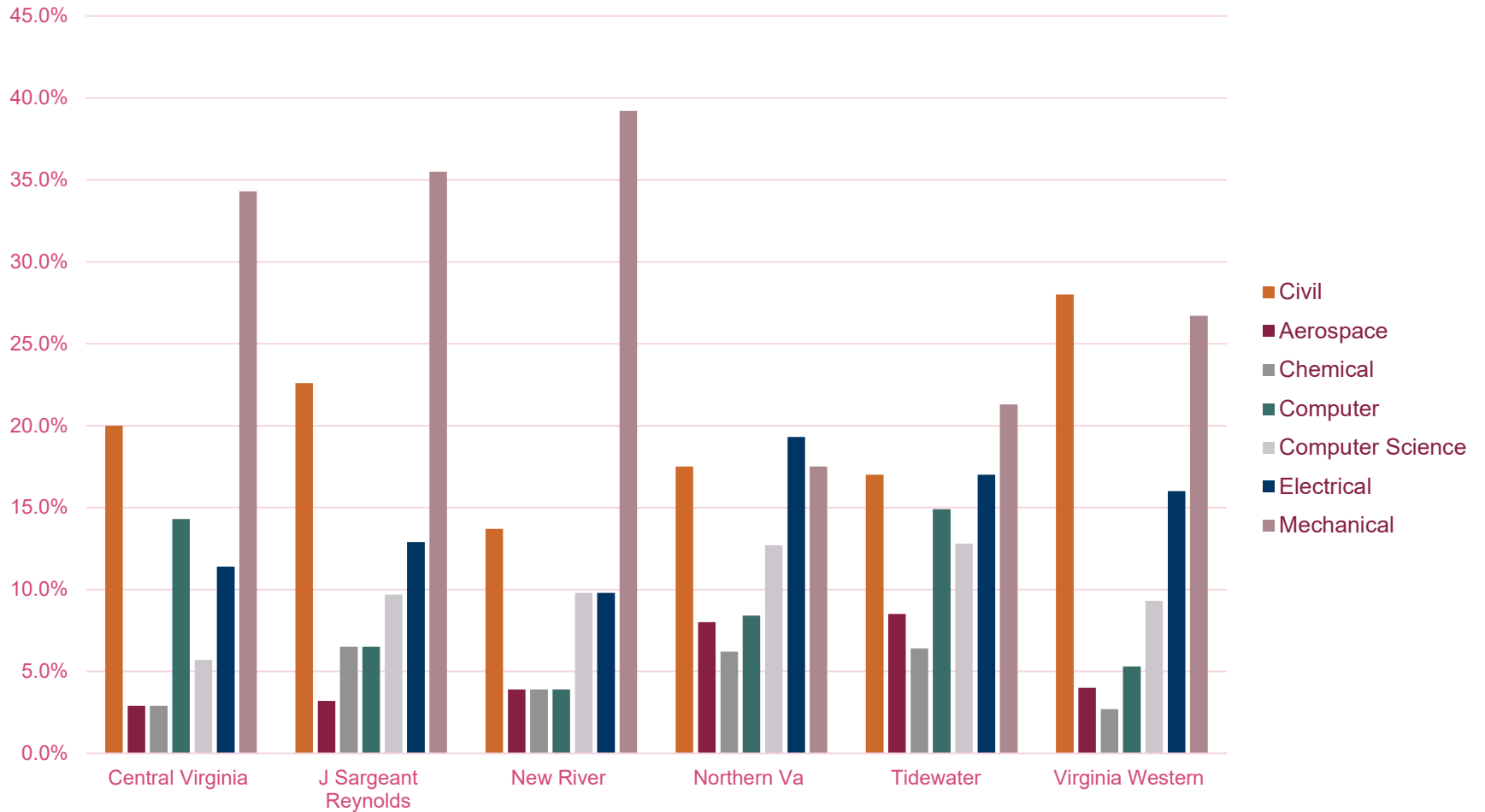
- $p < 0.001$  we reject the null hypothesis and conclude that credit loss differ between VCCS.
- Pairwise comparisons using Wilcoxon rank sum test with continuity correction

Boxplot of Credit Loss by VCCS Institution

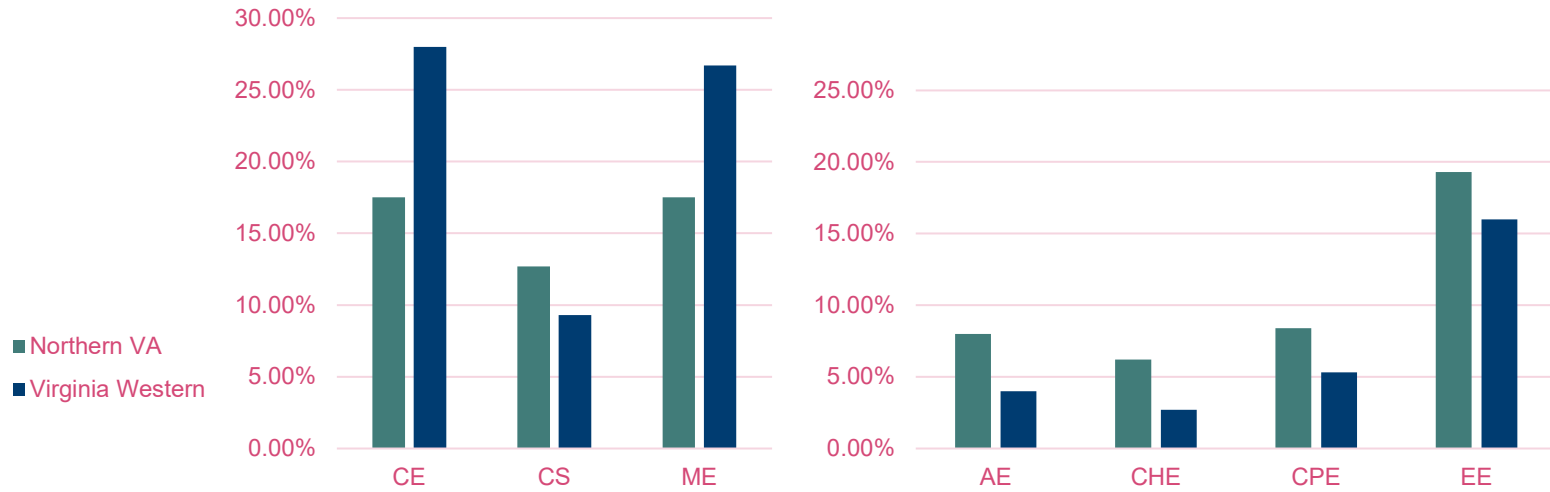


	COUNT	MEAN	MEDIAN
Central Va	35	21.57143	17
J Sargeant Reynolds	31	17.09677	16
New River	51	23.15683	16
Norther Va	275	21.75091	18
Tidewater	47	21.80851	22
Va Western	75	13.12	8

# PERCENTAGE OF TRANSFERS BY DISCIPLINE



# PERCENTAGE OF TRANSFERS BY DISCIPLINE



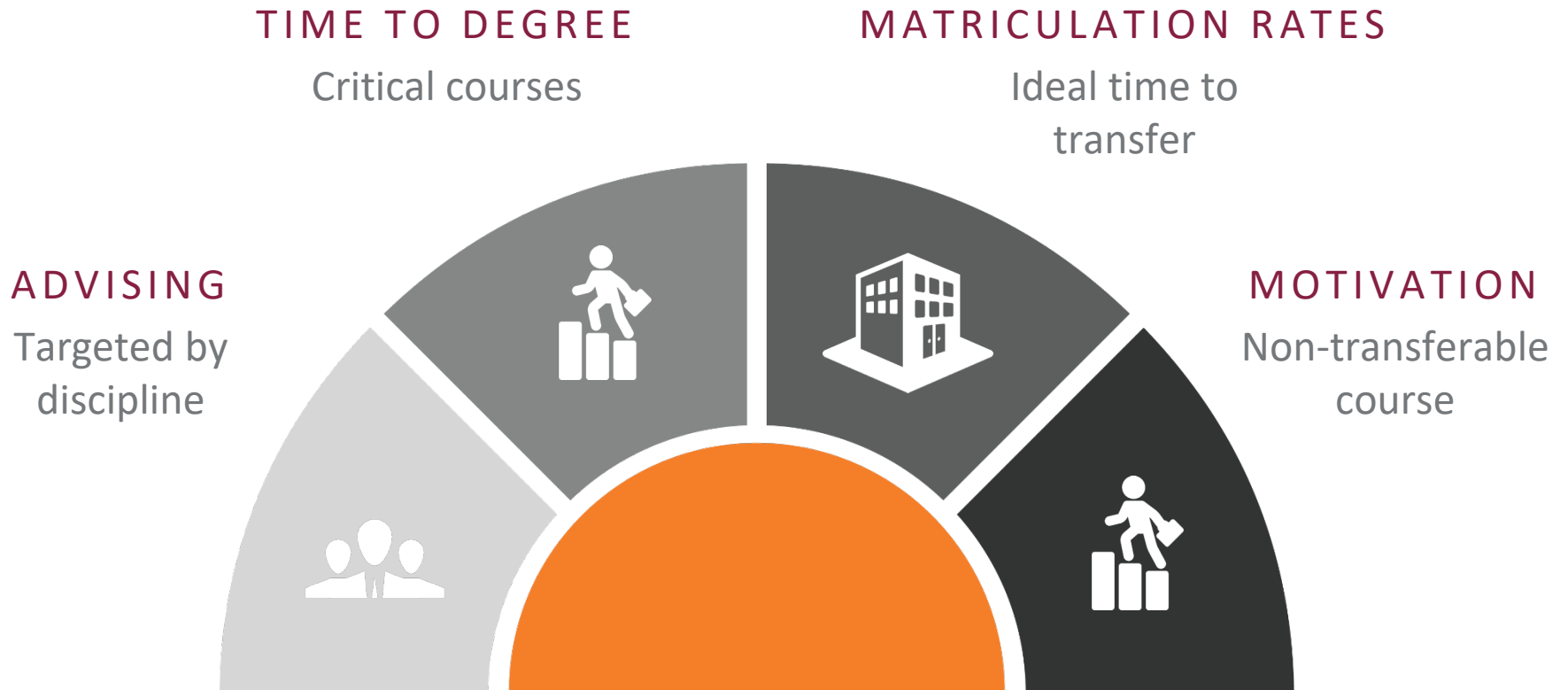


# FINDINGS

CREDIT  
LOSS  
DIFFERS  
BETWEEN

- Engineering disciplines
- Transfer types
- VCCS institutions

# IMPLICATIONS





WHAT ARE SOME USEFUL WAYS WHERE  
DISAGGREGATING DATA MIGHT SHOW A  
MORE NUANCED STORY?



## FUTURE WORK

- Transcript level data
- Disaggregate by institutional factors





## EXPLORING CREDIT LOSS FOR ENGINEERING TRANSFER STUDENTS

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