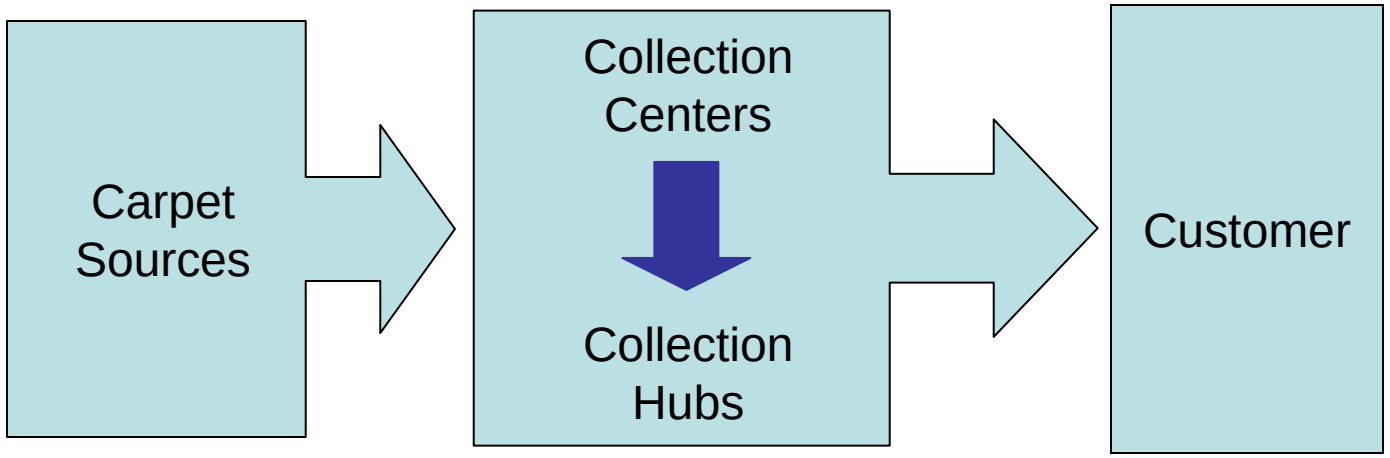
Initial Carpet Collection Logistics SE Region Case Study

Dr Matthew J Realff
School of Chemical & Biomolecular Engineering
Georgia Tech/NSF

Dr Tiravat Assavapokee
Department of Industrial Engineering
University of Houston

Dr Jane Ammons & Josh Pas
School of Industrial & Systems Engineering
Georgia Tech

Overall Model Framework



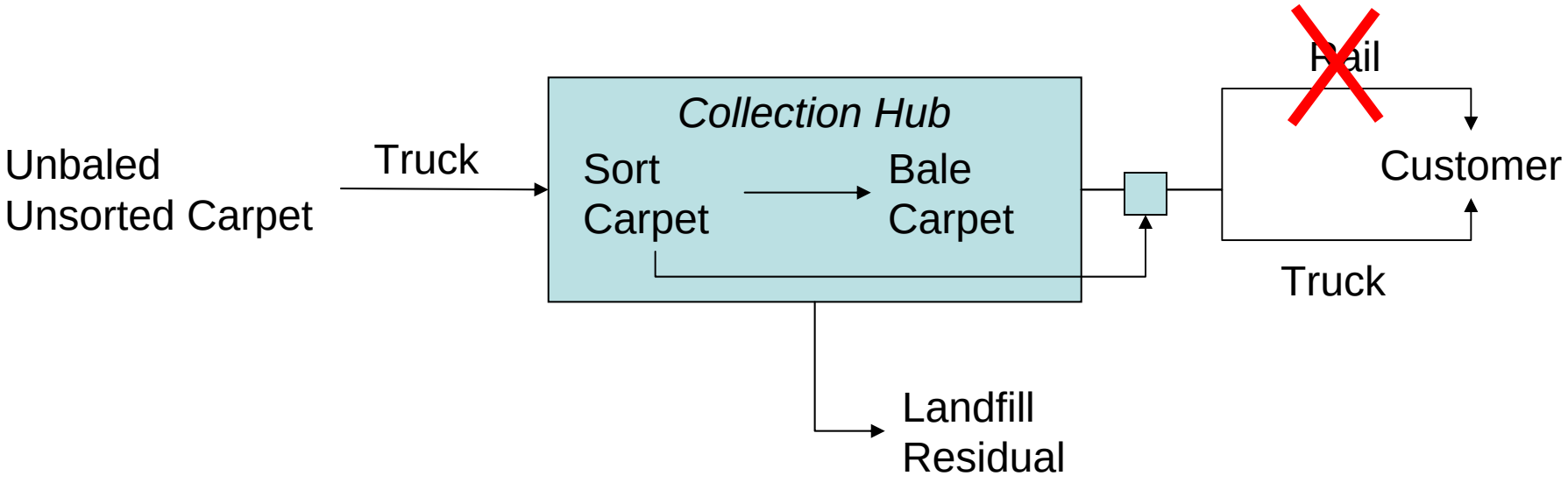
Where should the Collection Hubs be located?

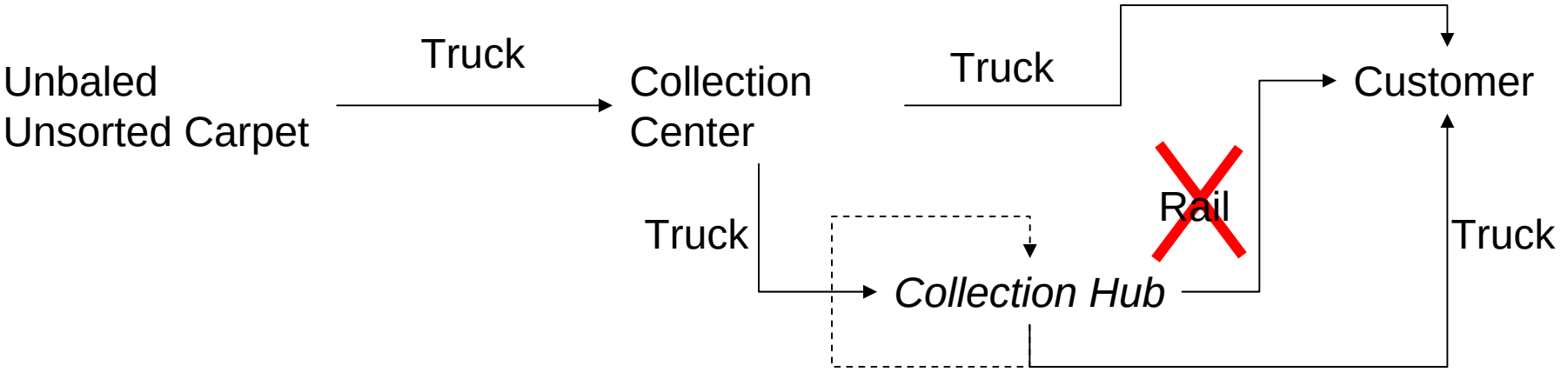
Which Collection Centers should ship directly to the customer?

Which Carpet Sources should be selected?

What tasks (sorting & baling) should be done and where?

Alternative Task Structures





Model Parameters

Truck Transportation

44,000 lbs baled

30,000 lbs unbaled

Cost breaks at distance

140 miles

250 miles

$7.57 **$3.6** **$2.6**

Cost per truckload mile

Rail 1/10th the cost of trucks per ton mile has a fixed cost, but is significantly cheaper.

Carpet must be baled to shipped by rail.

Model Parameters II

Carpet returns are assumed about 70% of new sales.
We only consider locations with more than 150,000 sq yard of carpet sale.

Process Type	Fixed Cost/Month	Capacity Millions lbs/month
Sorting	$2610	1.5
Horizontal Baler Vertical Baler	$4900 $4870	1.9 0.26

Collection Center $2100/month to open, $4,800 fixed operating cost per shift per month

Local Variable Collection Cost is 30 mile truck trip cost per loose lb collected

Hubs Cost $4200/month to open, $12,000 fixed operating cost per shift per month

Landfill Fee $35/ton

Model Objectives

- Minimize total cost of collection and transport of:
  - N6 Carpet to a location in Georgia from the SE region states (AL, FL, GA, NC,SC)
  - N6 Carpet to a location in Georgia from the SE region states (AL, FL, GA, NC,SC) assuming you double from the amount above.

N6 Carpet is assumed 33% of Total Carpet Stream

Model Studies

Parameter	Value	
Volume N6	30 million lbs Double to 60 million lbs	2
Participation Rate*	40%	1
Rail Available?	Yes or No	2

4 Sets of Results

* In the locations selected 40% of the volume is assumed to be able to be collected.

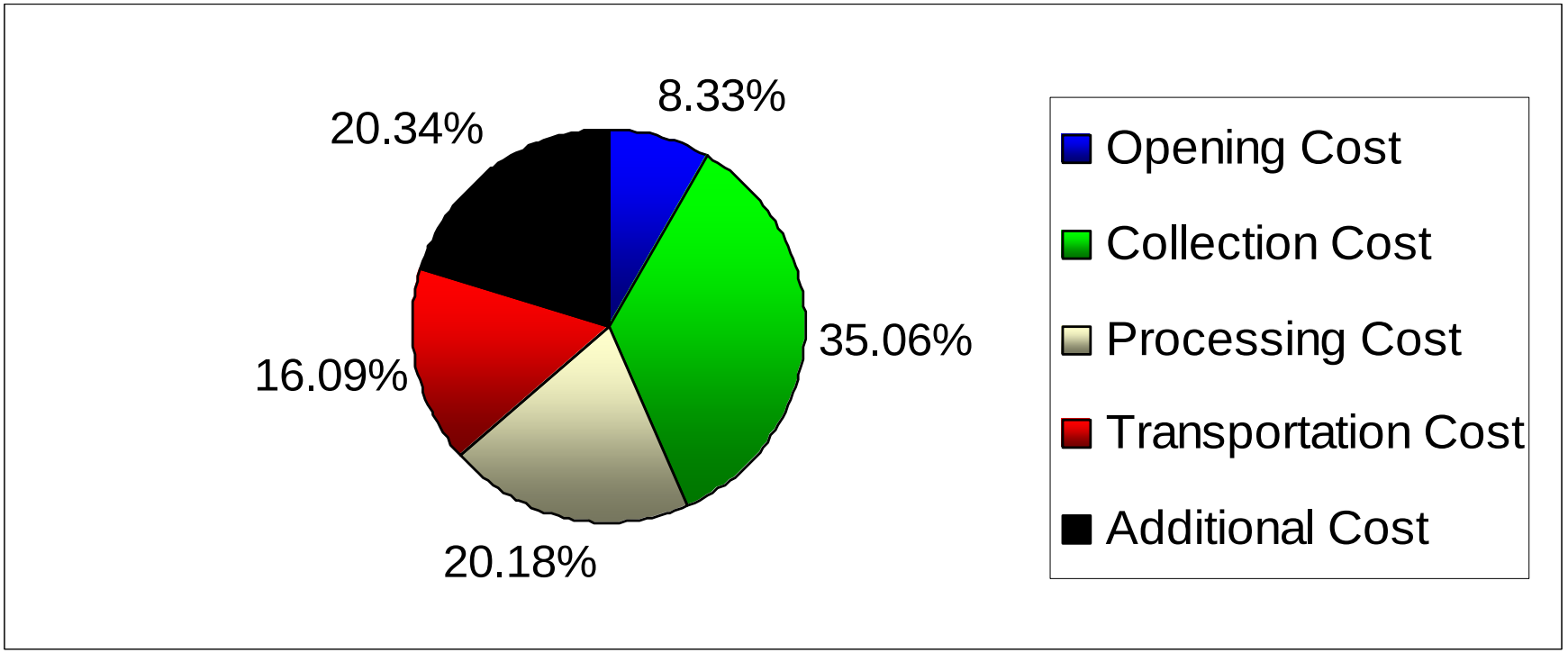
Results I

Blue = Regular Site Green = Hub Site

Parameter	Value
Volume N6	30 million lbs
Participation Rate	40%
Rail Available?	N

Monthly Cost $450,000

Cost Breakdown



Results II

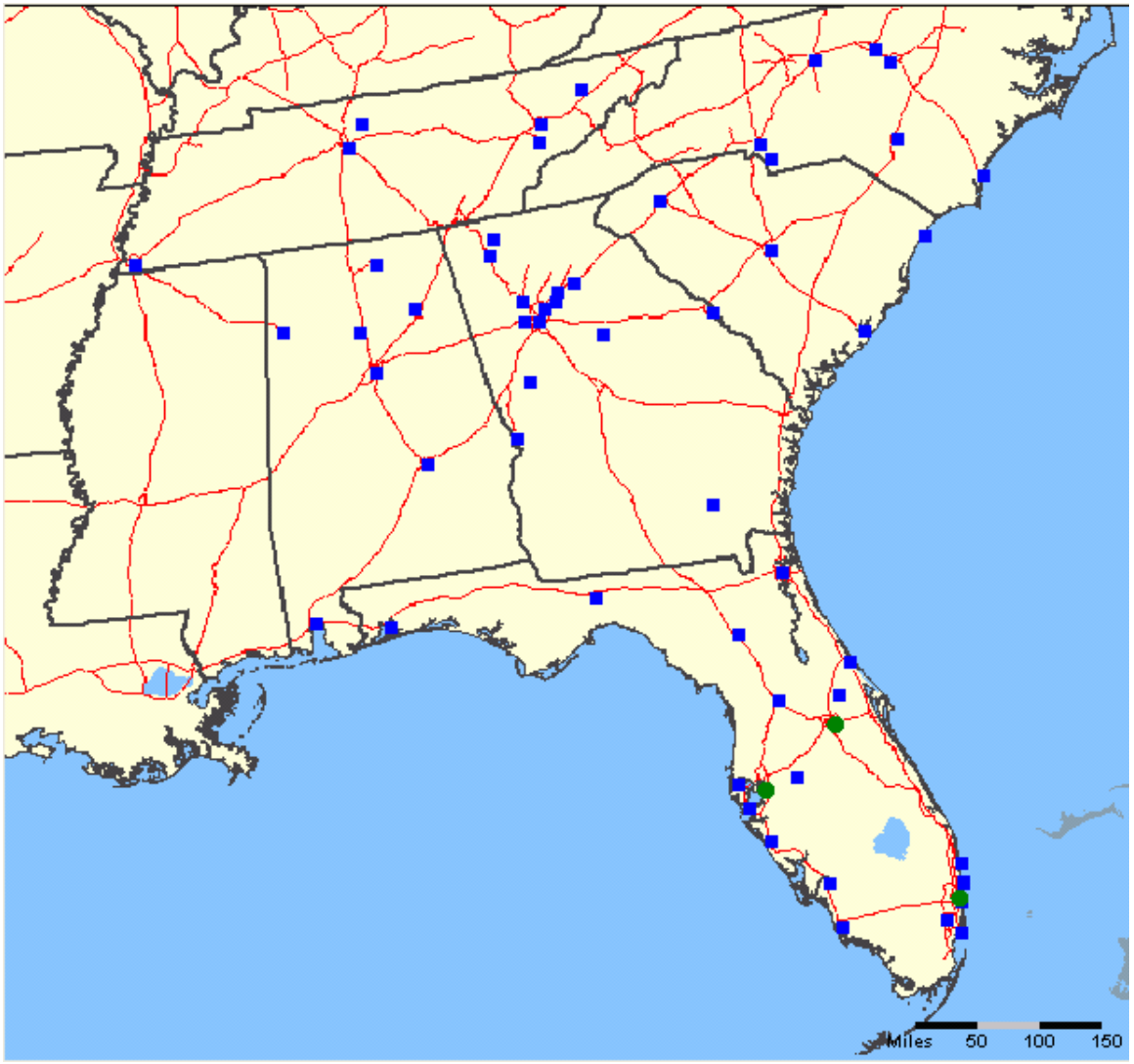
Parameter	Value
Volume N6	30 million lbs
Participation Rate	40%
Rail Available?	Y

Monthly Cost $403,000

Blue = Regular Site

Green = Hub Site

Results III



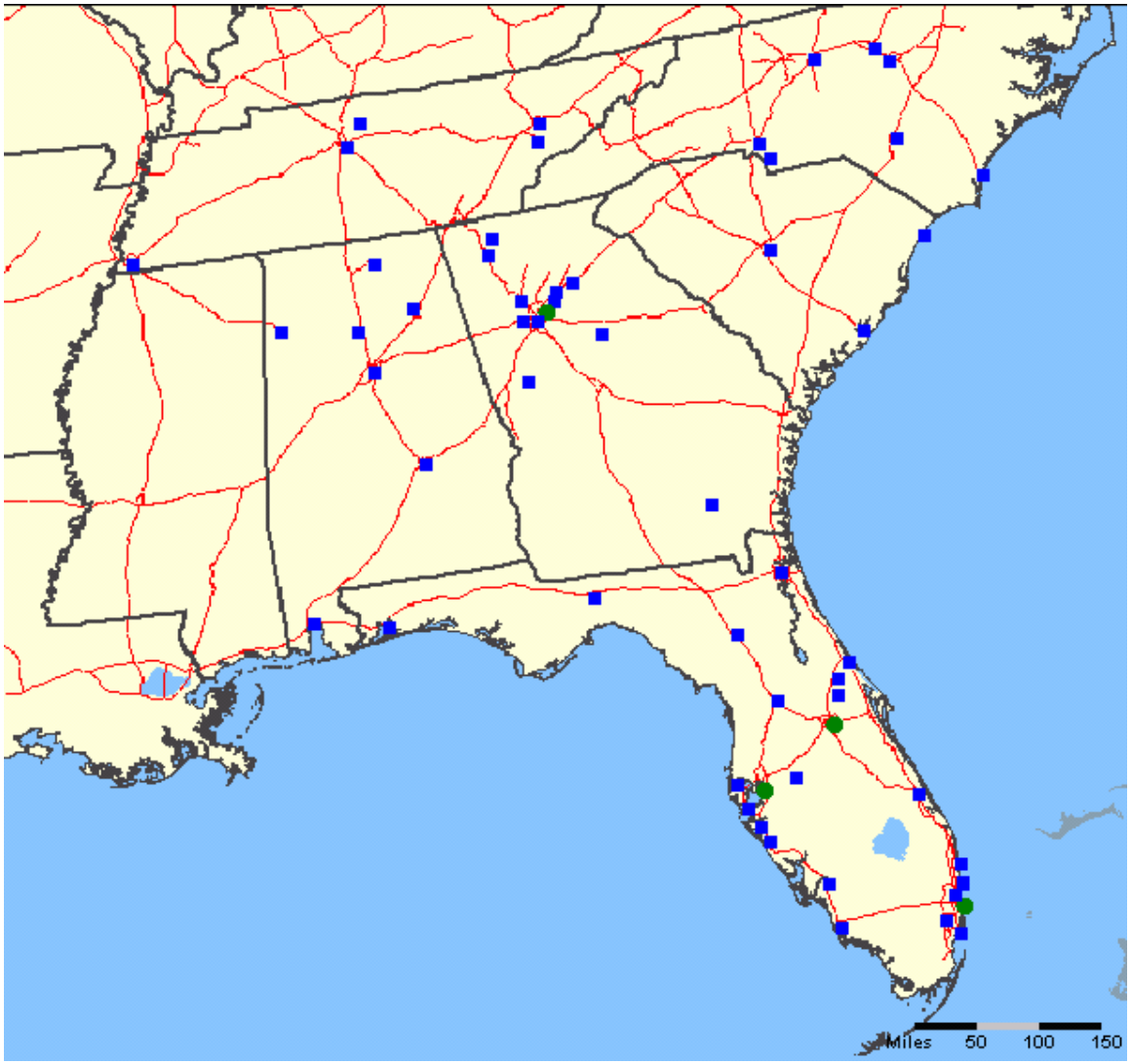
Parameter	Value
Volume N6	60 million lbs
Participation Rate	40%
Rail Available?	N

Monthly Cost $1,150,000

Blue = Regular Site

Green = Hub Site

Results IV



Parameter	Value
Volume N6	60 million lbs
Participation Rate	40%
Rail Available?	Y

Monthly Cost $1,000,000

Blue = Regular Site

Green = Hub Site

Summary

- Very flexible model of initial carpet collection.
  - All the model parameters can easily be changed
  - New customers for carpet types can be added
  - New processes for carpet can be added
- Model can be used to study sensitivity to assumptions.
- Model can be used to benchmark systems and explore opportunities *in silico*.