



Outline

- Background
- Design objectives
- Data
- Applications
 - Product distribution
 - Routing
- Limitations
- Conclusion

Background

- GIS can be used to improve warehouse operations
 - ArcGIS' Network Analyst can help:
 - Optimize product organization
 - Minimize the time clerks spend stocking shipments and assembling orders
- Application:
 - Velotech Inc. cycling retailer and warehouse



- Restocking products
- Assembling orders

Data Structure

- Two databases
 - MS Access product information DB
 - ESRI Geodatabase
 - Feature dataset
 - Feature classes
 - Network dataset
 - Relationship classes
 - Tables





Product Database

- Can query DB and export tables for spatial analysis in ArcMap
- Can connect to ArcMap via OLE Database connection

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Castelli	Ergo Tre Half Short	medium	black	
Castelli	Ergo Tre Knicker	medium	black	
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Castelli	Thermoflex Arm Warmers	medium black		
Castelli	Thermoflex Knee Warmers	medium black		
Castelli	Thermoflex Knee Warmers	medium	black	
Castelli	Thermoflex Leg Warmers	medium	black	
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Castelli	Velocissimo Half Short	medium	black	
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Castelli	Tenero Knicker	medium	black	
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• Warehouse multipatch feature class created in Google SketchUp, imported into ArcScene



Spatial Data

- Used ArcScene's 3D Editor to create point and line feature classes
 - Points for shelf locations
 - Lines for traversable paths





• Shelf feature class attributes:

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Spatial Data

- Created a network dataset with the point and line classes
 - Cost in walking speed (placeholder seconds)
 - Full connectivity
 - No turns modeled
 - No path names (no directions)



Application: Product Distribution

- Use an Origin-Destination Cost Matrix to optimize product locations by sales, box size, and location
 - Run OD Cost Matrix in Network Analyst
 - Assign location for origin
 - Assign locations for destinations
 - Solve
 - Combine shelf ranking results with product DB sorted by sales and stock box size







- Export point table, now including ranks (ShelfODOutput)
- Open in Excel alongside exported Access table with product ID, sales, and box size
- Integrate by sorting, copying
- Save new table (ProductsPlaced), import back into ArcGIS
- Join product ID, sales, and box size information into point feature class, save by creating new fields



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Application: Picking an Order

- Add ordered products table to ArcMap document with geodatabase
- Join to Points file by product ID
- Query for points that host these products
- Add these locations to Vehicle Routing Problem tool in Network Analyst
- Add routes to VRP, define depot as Origin
- Solve and display



Application: Stocking a Shipment Add pack-slip table to ArcMap document

- with geodatabase
- Join to Points file by product ID
- Query for points that host these products
- Add these locations to Vehicle Routing Problem tool in Network Analyst
- Add routes to VRP, define depot as Origin
- Solve and display



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	5	Point ZM	6	7	HL-EL135 Opticube Light White	
	2	Point ZM	3	8	Adventure Digital Wireless Cyclecomputer	
	10	Point ZM	11	9	Reflex Auto Tail Light	
	3	Point ZM	4	10	Commuter Wireless Cyclecomputer	
4	15	Point ZM	16	11	Strada Wireless Cyclecomputer RD300W Black	
4	12	Point ZM	13	12	Strada CC-RD100 Cyclecomputer Black	
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Limitations

- Current topology point/line rules do not work with 3D
- Simplified version of warehouse, paths
- ArcGIS and Access do not fully integrate
 - Would need to create web application that integrates with both ArcGIS and Access in order to have Velotech staff & other users create a warehouse, run and re-run analyses easily



Conclusions

- We have developed a geodatabase structure that can be used for our intended applications
- Much more work is needed in automation, tool/model scripting, and development of a user interface in order for real businesses to use our product
- 3D display and analysis with ArcGIS 10 leaves a lot of room for improvement

