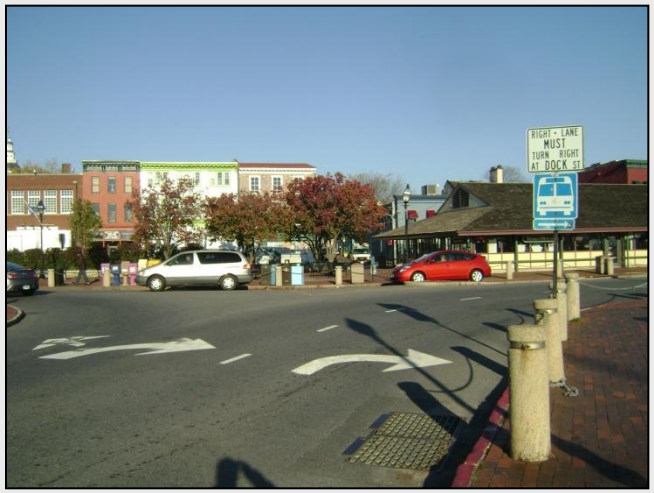
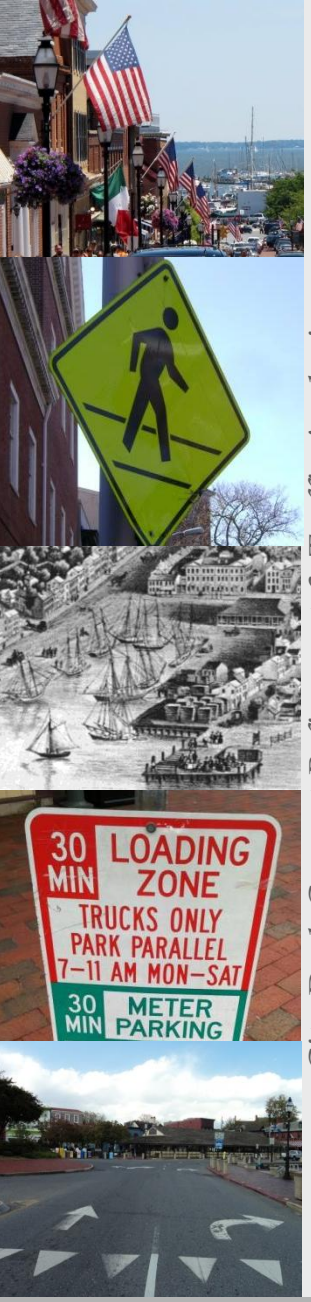
City of Annapolis



City Dock Concept Refinement & Traffic Analysis

October 19, 2011



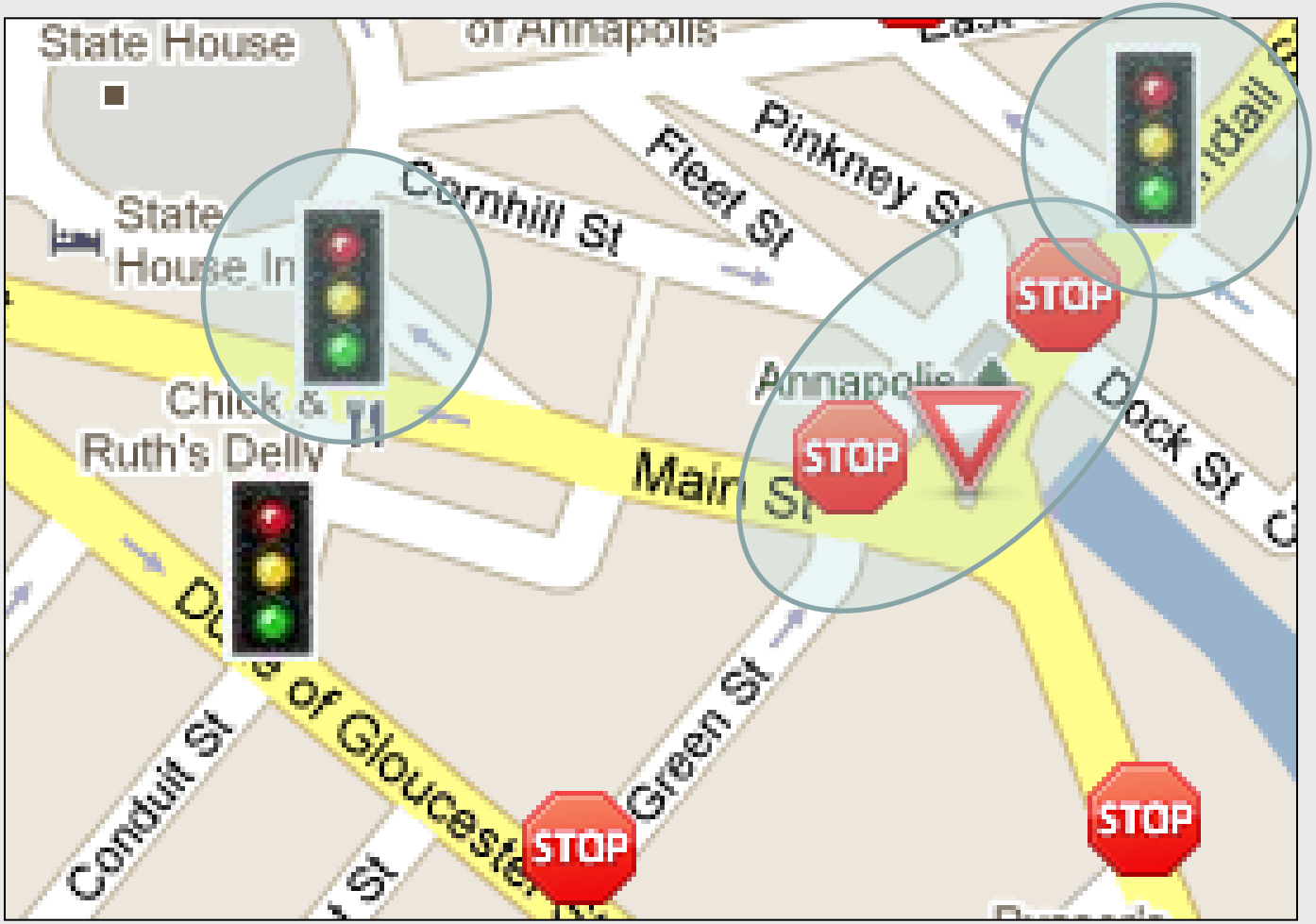
City Dock Concept Refinement & Traffic Analysis

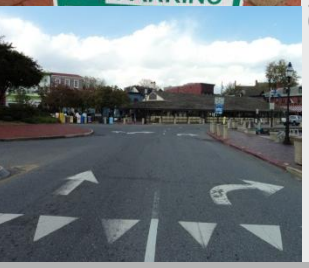
Outline

- Study Goals and Objectives
- Existing Conditions
- Methodology and Data Collection
- Alternatives
  - Refinement
  - Evaluation
  - Simulation

- Findings
- Summary of next steps

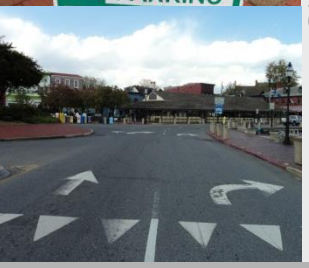
Study Area and Intersections





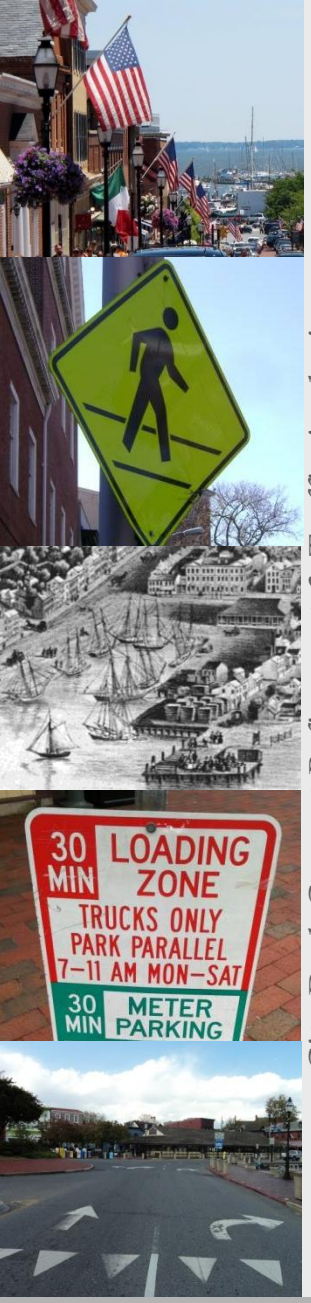
Study Goals and Objectives

- **Public Space & Access:** Create larger, more flexible open spaces and provide improved access to the City Dock waterfront
- **Safety:** Improve transportation safety (both real and perceived) for pedestrians, bicyclists, and motorists in the City Dock area
- **Aesthetics:** Preserve and enhance the historic character and vistas of City Dock
- **Business Access:** Preserve parking and loading zones as close to existing levels as possible
- **Traffic Operations:** Manage traffic congestion to within acceptable levels



Existing Conditions

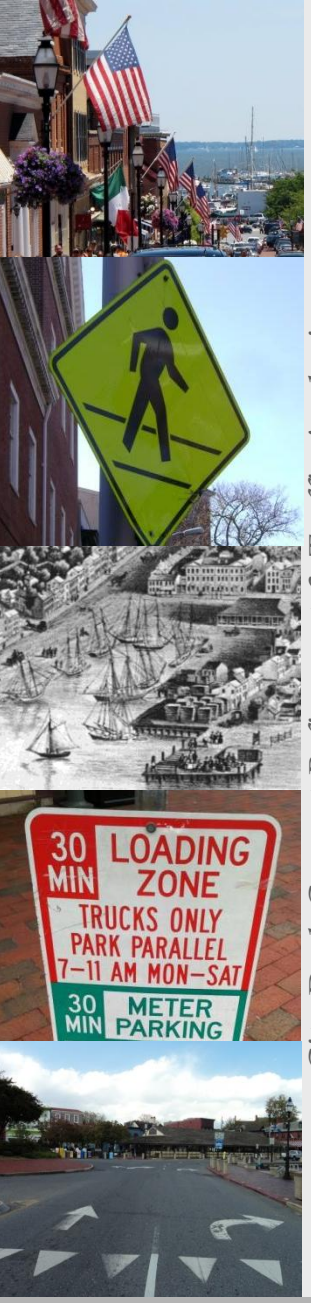
- **Public Space & Access:**
  - Large roundabout is visual barrier
  - Wide crossings can be challenge for pedestrians
  - Narrow sidewalks near waterfront due to large footprint
- **Safety:** Low crash rate (2 per year, none serious)
- **Aesthetics:** “the real thing”
- **Business Access:** Parking and loading at or near capacity much of the time
- **Traffic Operations:** Works well on weekdays, but heavy congestion on many weekends



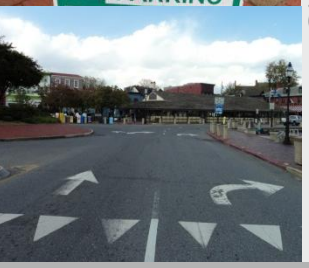
City Dock Concept Refinement & Traffic Analysis

Methodology and Data Collection

- Existing **parking occupancy** and **loading zone usage** inventoried
- **Crosswalks** located to provide good safety balanced with most direct lines of pedestrian access
- Corner radii and other geometric elements of concepts refined to accommodate targeted **delivery routes**
- **Parking** replaced where possible to offset losses with goal of minimal net change in on-street parking
- Refinements made to preserve **viewshed** and incorporate new **loading zone** areas
- Concepts evaluated using transportation **modeling & simulation** software (Synchro, SIDRA, & VISSIM)



Existing On-Street Parking Zones



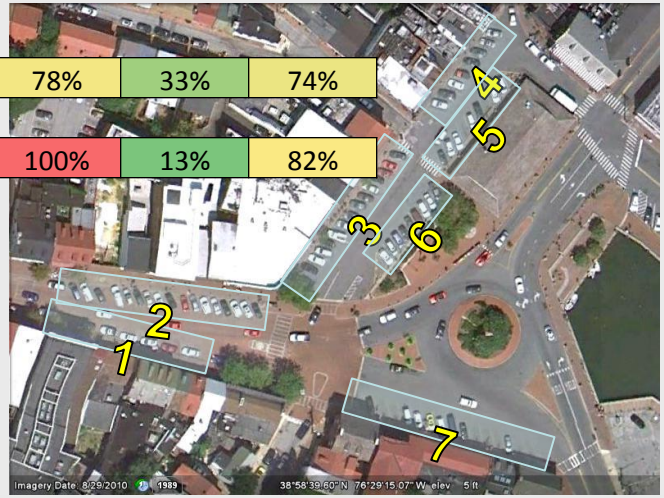
City Dock Concept Refinement & Traffic Analysis

Weekday Parking Utilization

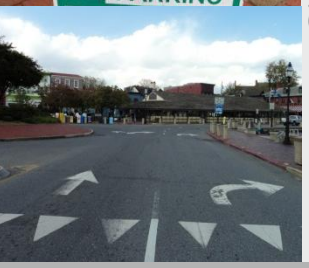
Wednesday 9/21/11

Percent Utilized

Time	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Total
9:30 AM	83%	100%	93%	100%	0%	0%	53%	64%
10:00 AM	67%	93%	93%	100%	0%	11%	73%	67%
10:30 AM	67%	79%	80%	50%	0%	11%	40%	50%
11:00 AM	100%	86%	93%	100%	22%	11%	27%	62%
11:30 AM	83%	86%	93%	100%	44%	67%	33%	71%
11:45 AM	67%	93%	100%	88%	44%	100%	33%	75%
12:00 PM	100%	86%	100%	100%	89%	100%	40%	84%
12:15 PM	100%	100%	100%	75%	67%	78%	67%	84%
12:30 PM	83%	100%	100%	100%	44%	100%	93%	91%
12:45 PM	83%	93%	87%	100%	78%	100%	60%	84%
1:00 PM	100%	86%	87%	88%	56%	100%	27%	74%
1:15 PM	100%	100%	93%	100%	78%	100%	33%	83%
4:55 PM	67%	86%	93%	100%	67%	78%	33%	74%
6:05 PM	100%	100%	93%	100%	100%	100%	13%	82%



- Zones 3 has 2 handicap spaces
- Zones 5 and 7 include 30 min. parking



City Dock Concept Refinement & Traffic Analysis

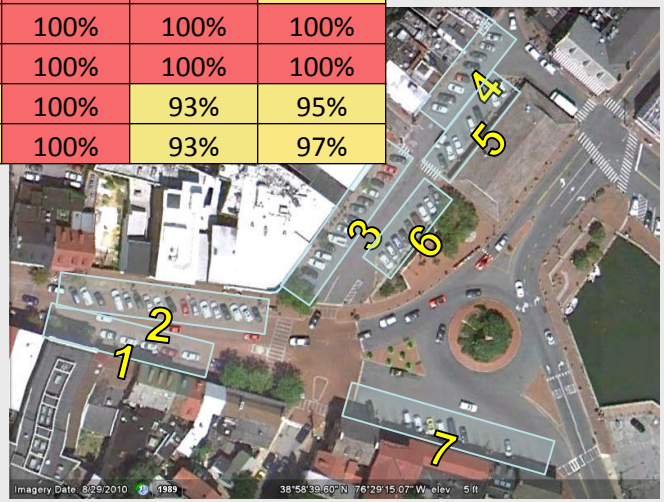
Saturday Parking Utilization

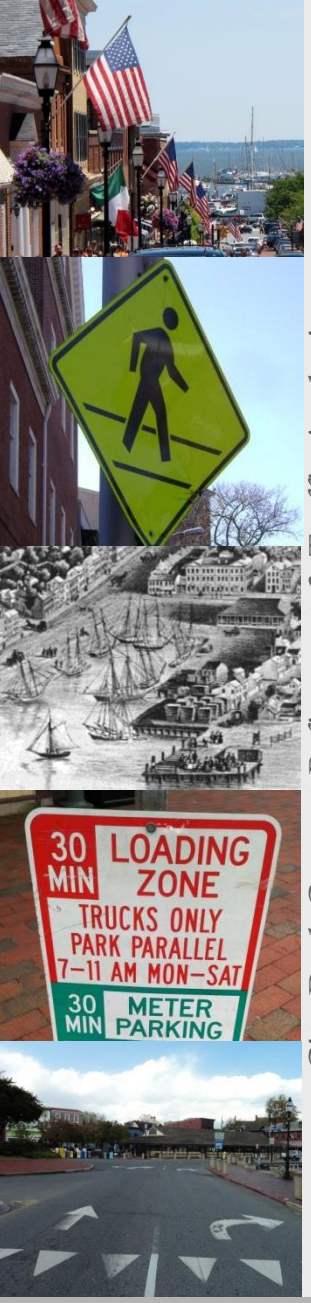
Saturday 9/24/11

Percent Utilized

Time	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Total
9:15 AM	50%	36%	80%	75%	33%	11%	20%	43%
9:45 AM	67%	71%	93%	100%	56%	11%	47%	64%
10:15 AM	83%	93%	93%	100%	56%	22%	53%	72%
10:30 AM	100%	79%	93%	100%	67%	33%	40%	71%
12:00 PM	100%	100%	100%	100%	100%	100%	93%	99%
12:15 PM	100%	100%	93%	100%	100%	100%	93%	97%
12:30 PM	100%	100%	93%	100%	100%	100%	87%	96%
12:45 PM	100%	100%	93%	100%	100%	100%	73%	93%
1:00 PM	100%	100%	93%	100%	100%	100%	100%	99%
6:15 PM	100%	93%	100%	100%	100%	100%	100%	99%
6:30 PM	100%	100%	100%	100%	100%	100%	100%	100%
6:45 PM	100%	100%	100%	100%	100%	100%	100%	100%
7:00 PM	100%	100%	100%	75%	89%	100%	93%	95%
7:15 PM	100%	100%	100%	100%	89%	100%	93%	97%

- Zone 3 has 2 handicap spaces
- Zones 5 and 7 include 30 min. parking

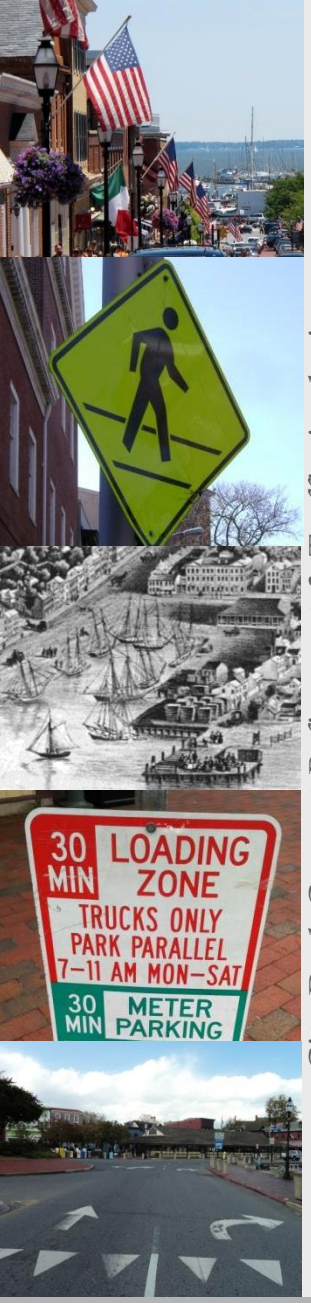




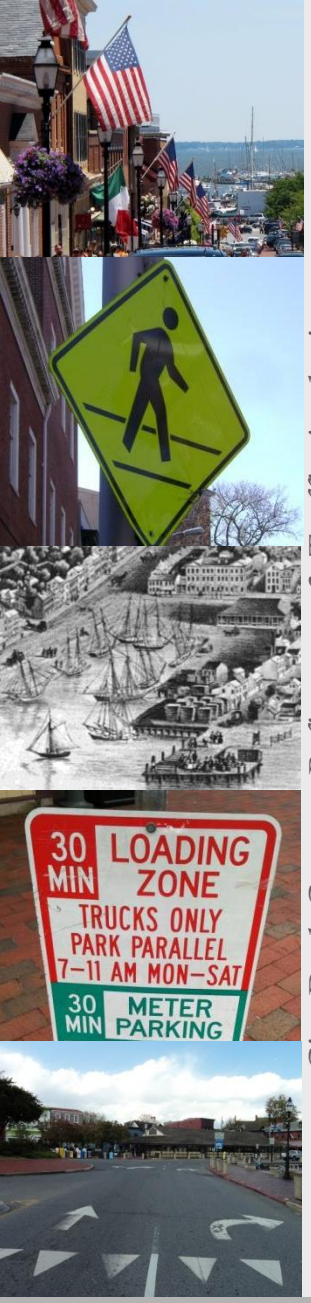
Existing Loading Areas

Signed Loading Zones

Unofficial Loading Areas

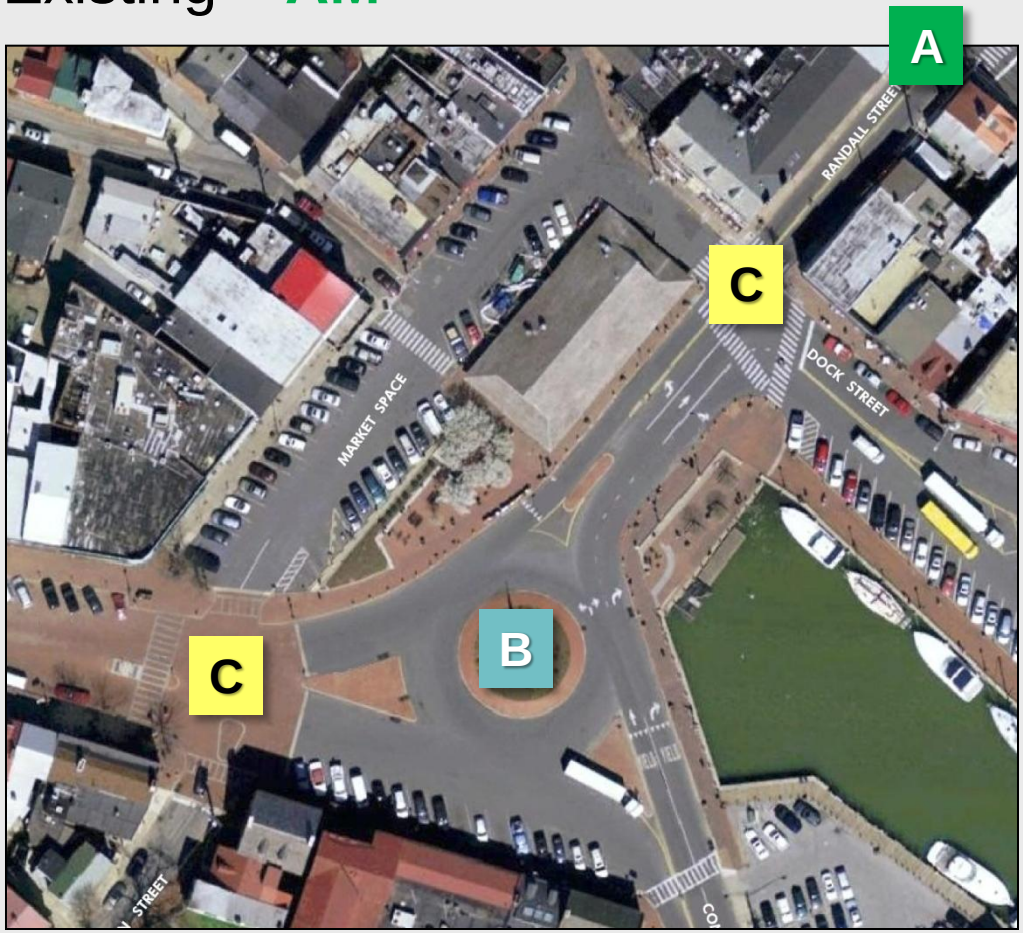


Existing Loading Activity



Operational Analysis

Existing – AM

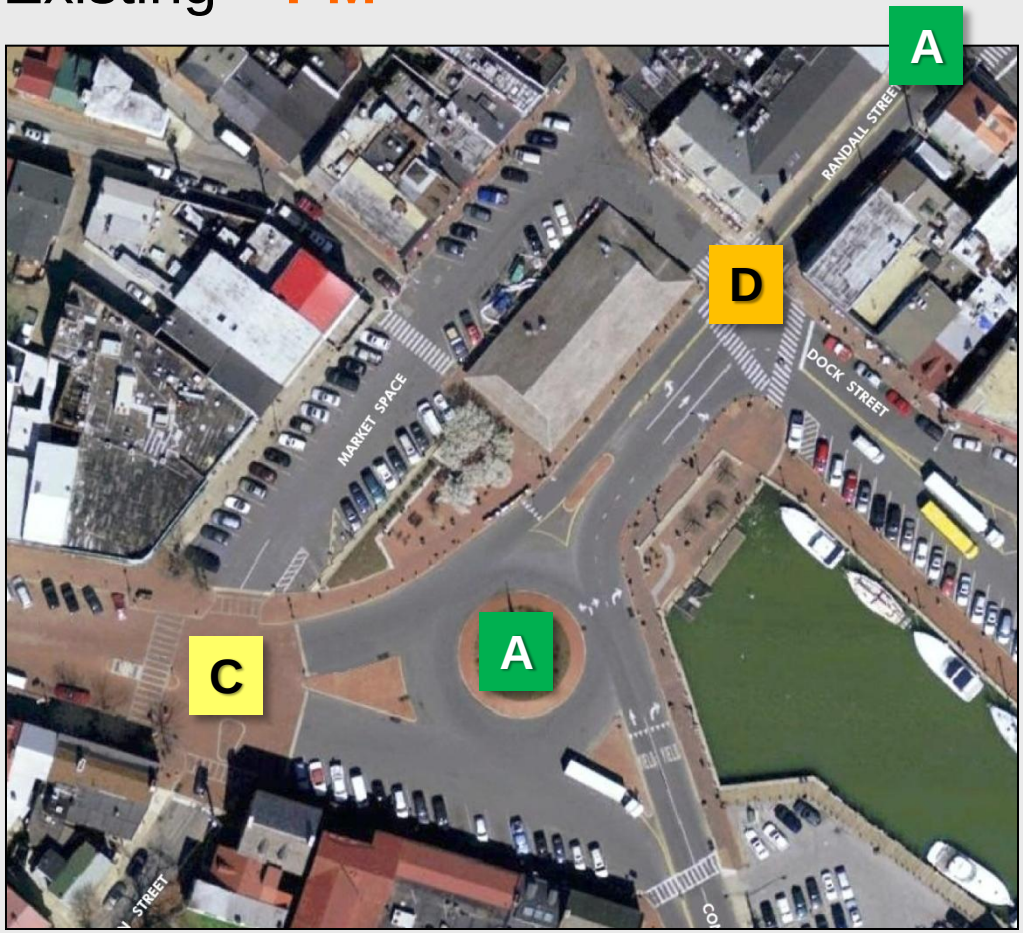


	Avg. Delay
A	≤ 10 sec
B	≤ 20 sec
C	≤ 35 sec
D	≤ 55 sec
E	≤ 80 sec
F	> 80 sec

City Dock Concept Refinement & Traffic Analysis

Operational Analysis

Existing – PM



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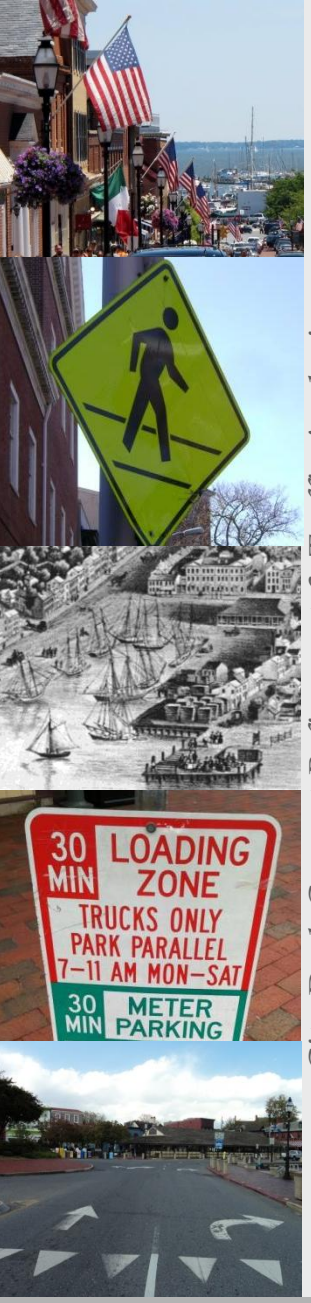
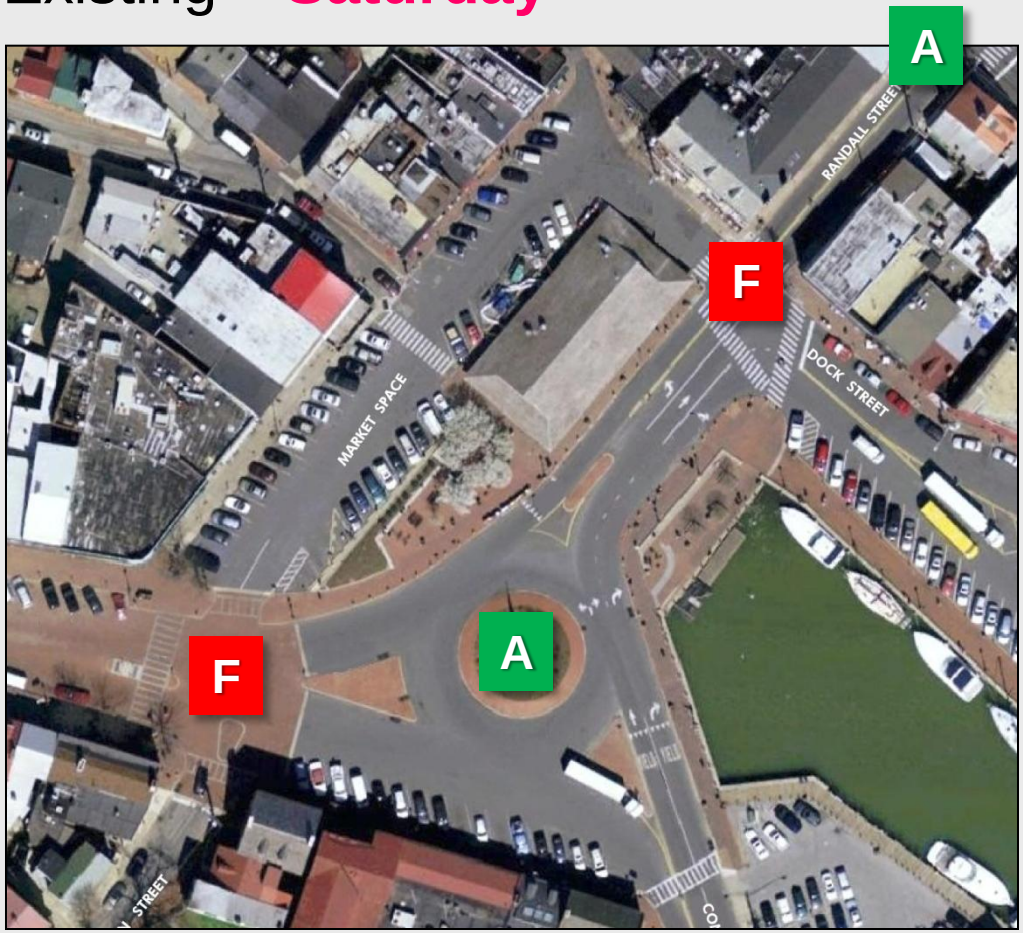


City Dock Concept Refinement & Traffic Analysis

Operational Analysis

Existing – Saturday



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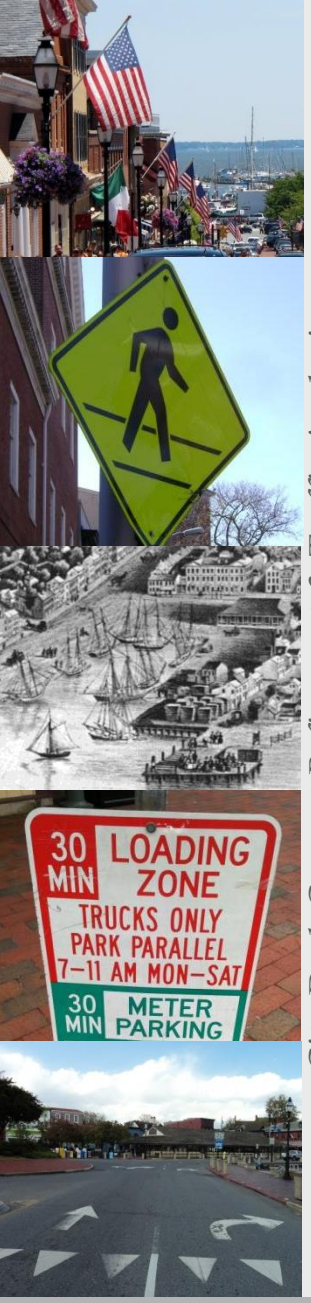
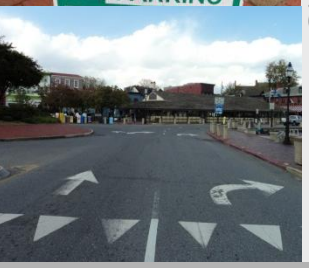
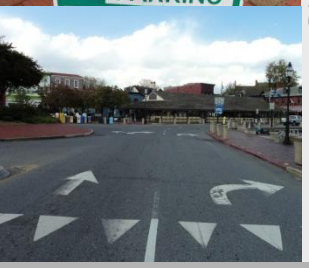


VISSIM Simulation – Existing Saturday



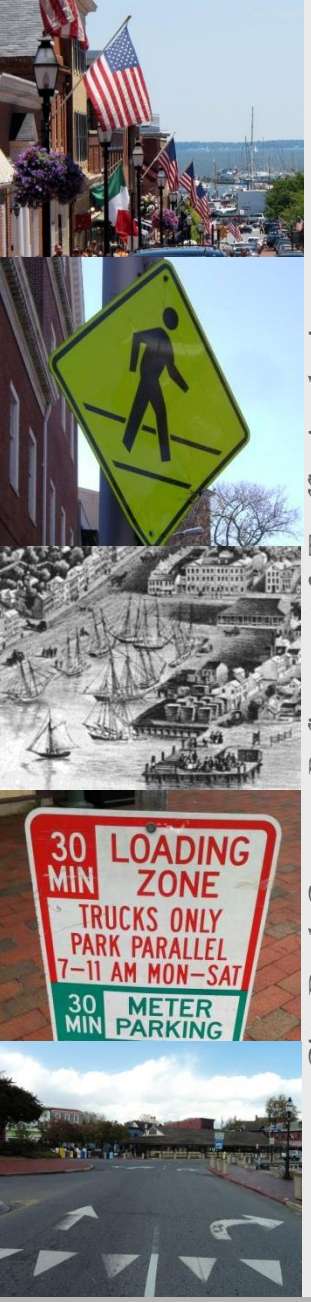
City Dock Concept Refinement & Traffic Analysis

Memorial Circle – Option 1



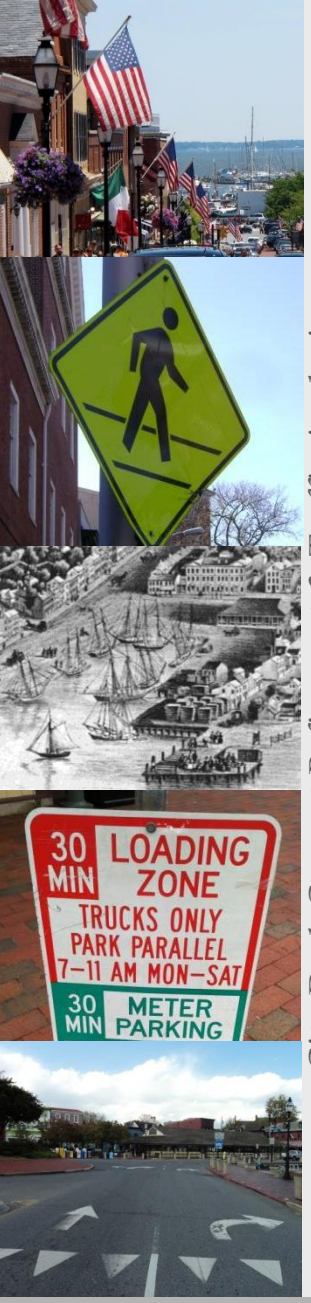
City Dock Concept Refinement & Traffic Analysis

T-Intersection – Aligned with Main St Option 2a



City Dock Concept Refinement & Traffic Analysis

T-Intersection – Aligned with Randall St Option 2b

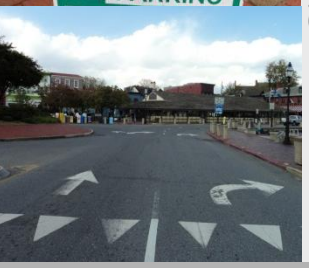


City Dock Concept Refinement & Traffic Analysis

Option 1 – Public Space & Access

Pros

- Adds new crosswalk at pedestrian desire line south of Market House
- Shortens pedestrian crossing distances

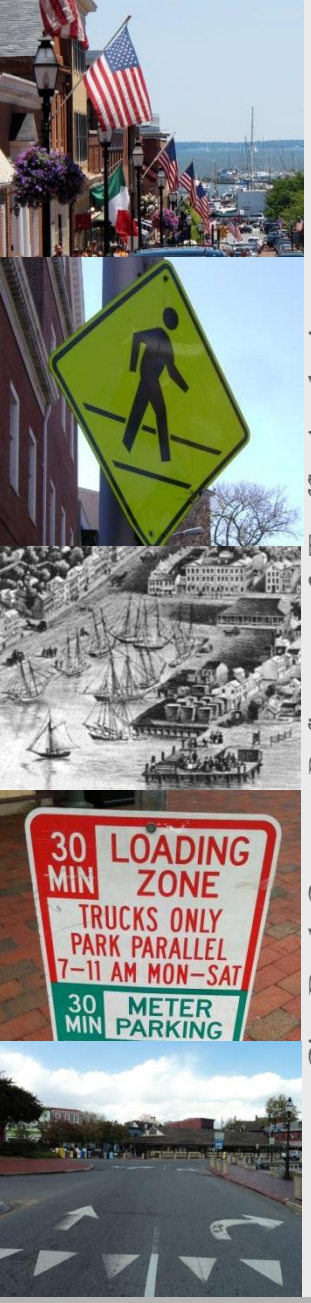


City Dock Concept Refinement & Traffic Analysis

Option 1 – Public Space & Access

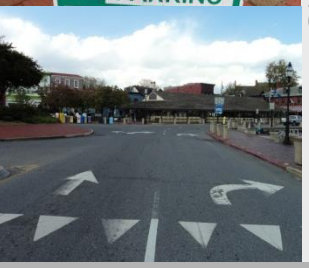
Cons

- Continued high pedestrian delay and discomfort due to lack of predictability about when drivers will yield
- Least amount of new public space among options – “locked up” in center of circle
- Roundabout remains less friendly to bicycles than other options



City Dock Concept Refinement & Traffic Analysis

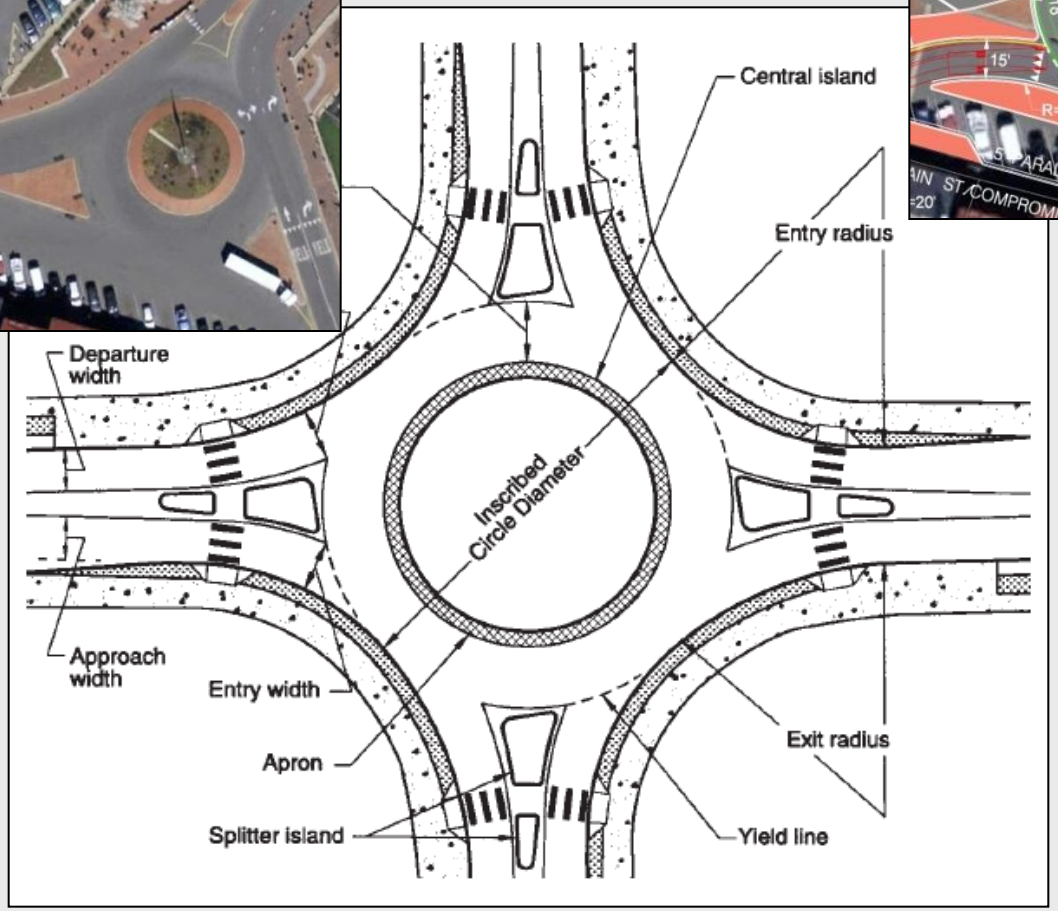
Option 1 – Public Space & Access



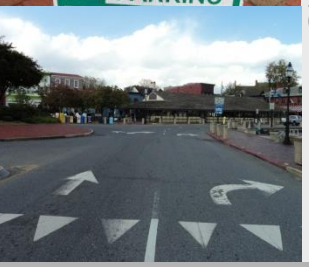
City Dock Concept Refinement & Traffic Analysis

Option 1 – Safety

Modern Roundabouts



Modern roundabouts differ from rotaries and traffic circles which have higher speeds, stop or signal control at entry points, little or no deflection and active uses in the center island.



City Dock Concept Refinement & Traffic Analysis

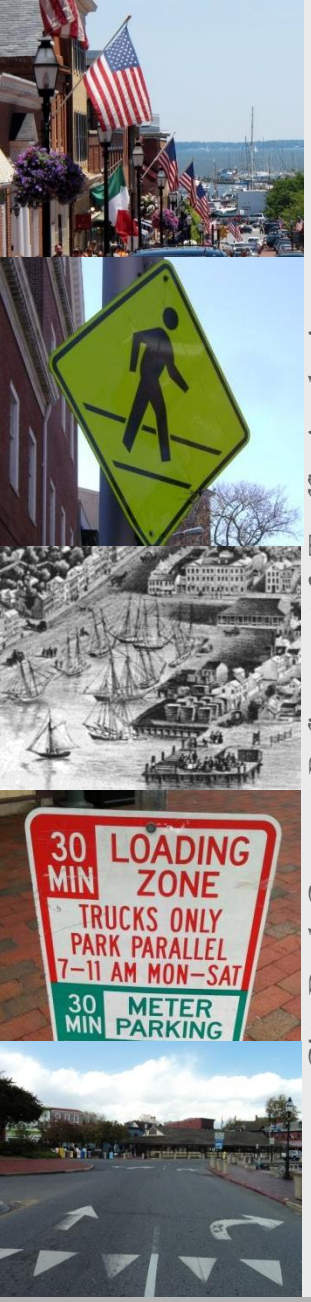
Option 1 – Safety

Pros

- Similar to existing Memorial Circle, which has excellent safety record (0 crashes 2007-2009)
- Circle made into somewhat safer roundabout by narrowing lanes and deflecting traffic on all approaches to reduce speeds

Cons

- Minimal increase in "perceived" safety… will still feel like a "free-for-all" during busy pedestrian hours, but when people *feel* unsafe they usually respond and act in a safer manner.



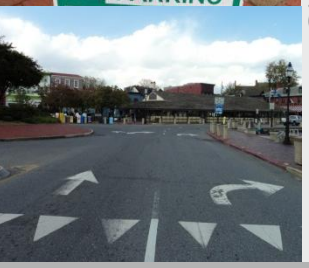
Option 1 – Aesthetics

Pros

- No signal heads to impact Main St viewshed toward water
- Retains late 20th century form of Memorial Circle

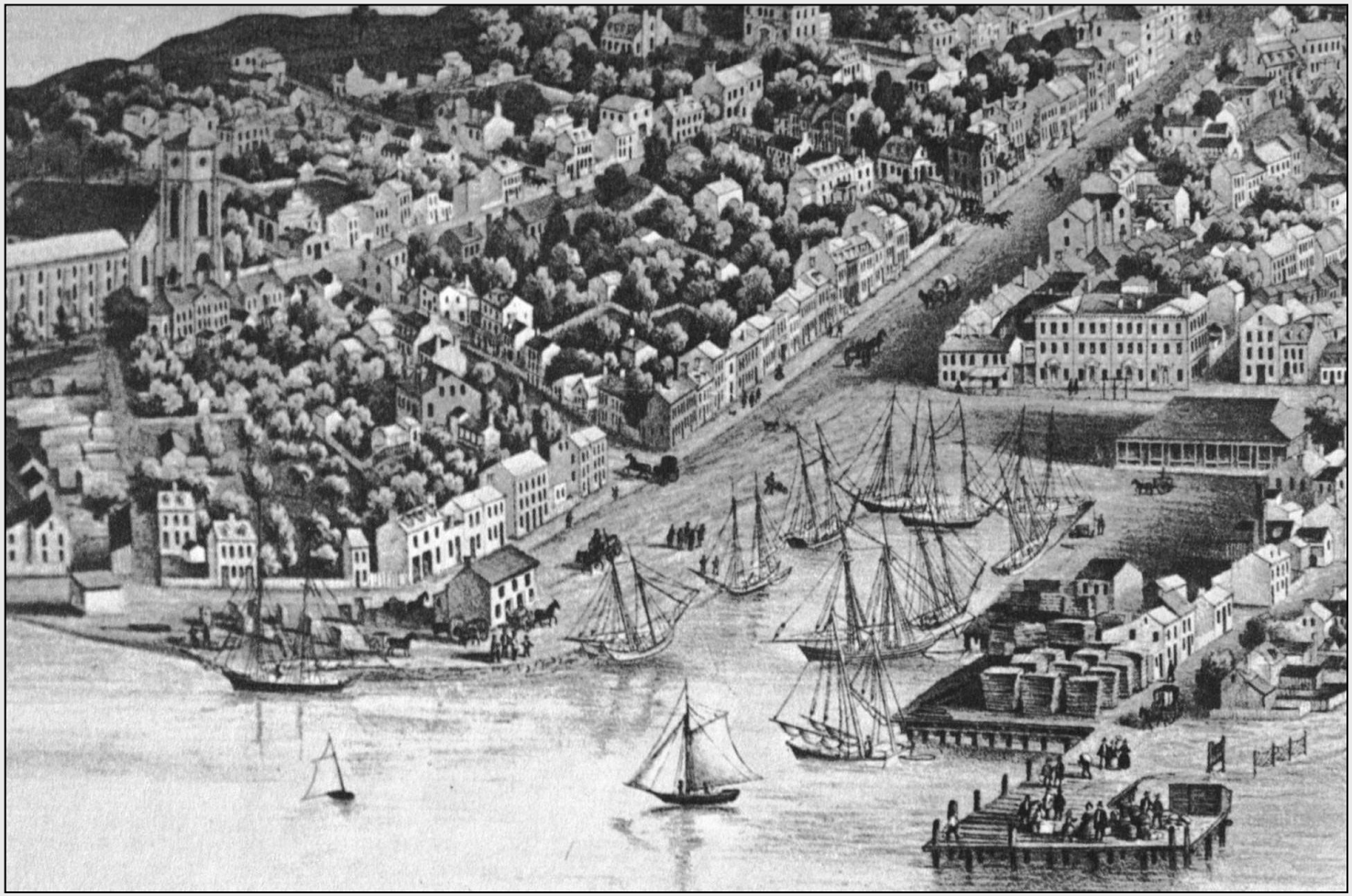
Cons

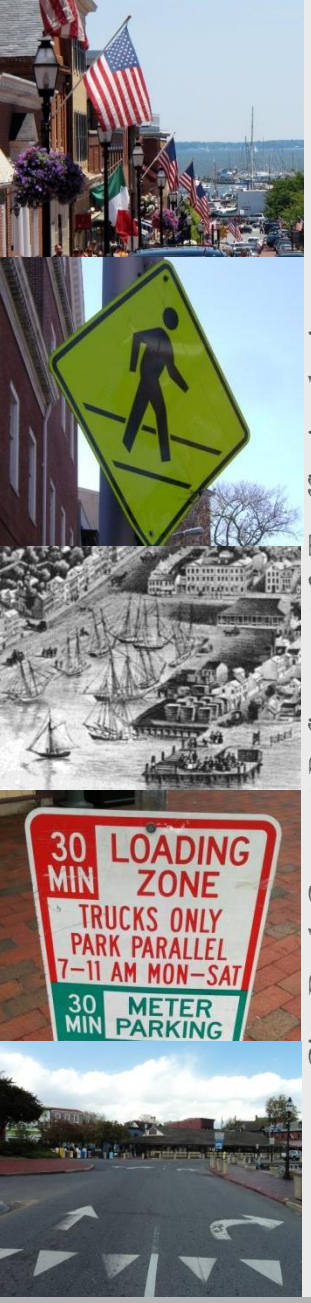
- Smaller roundabout shifted south, partially into Main St viewshed
- Roundabout not consistent with earlier 18th and 19th century history of the intersection



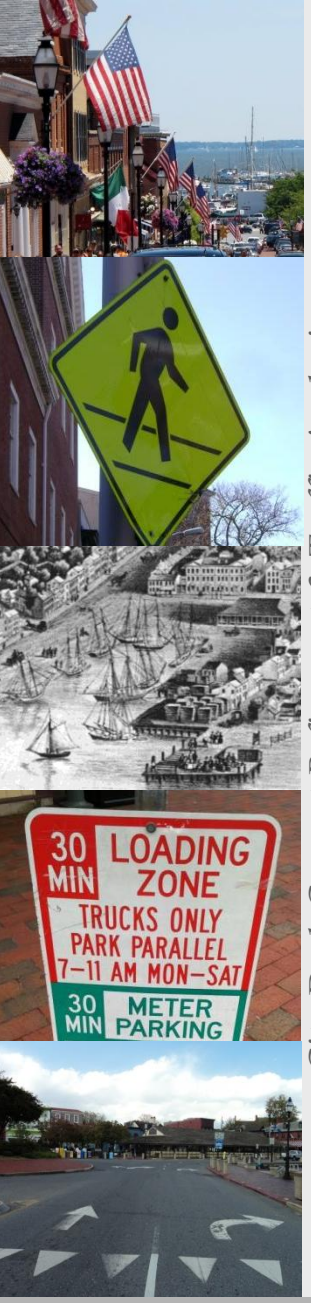
City Dock Concept Refinement & Traffic Analysis

City Dock – early street layout

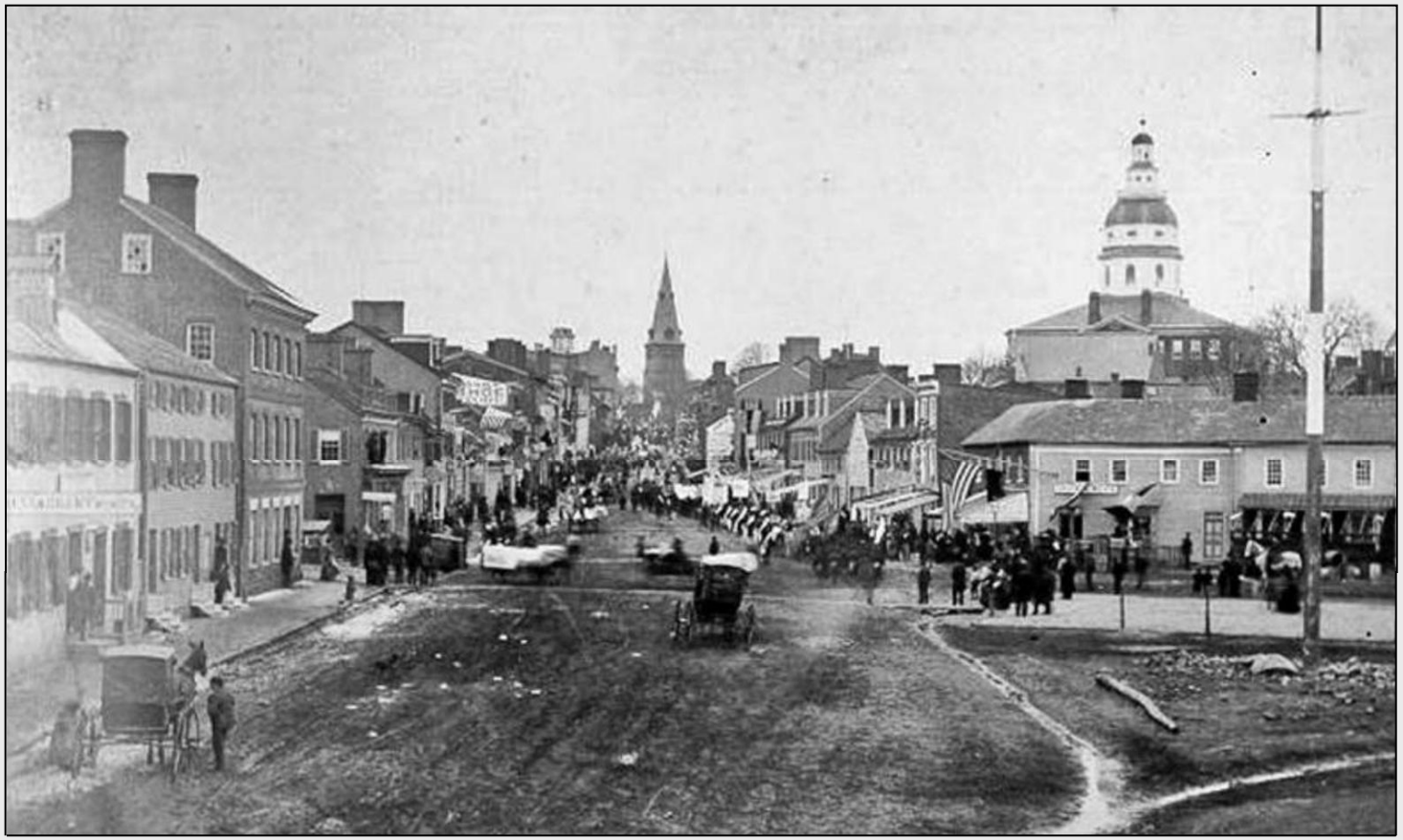


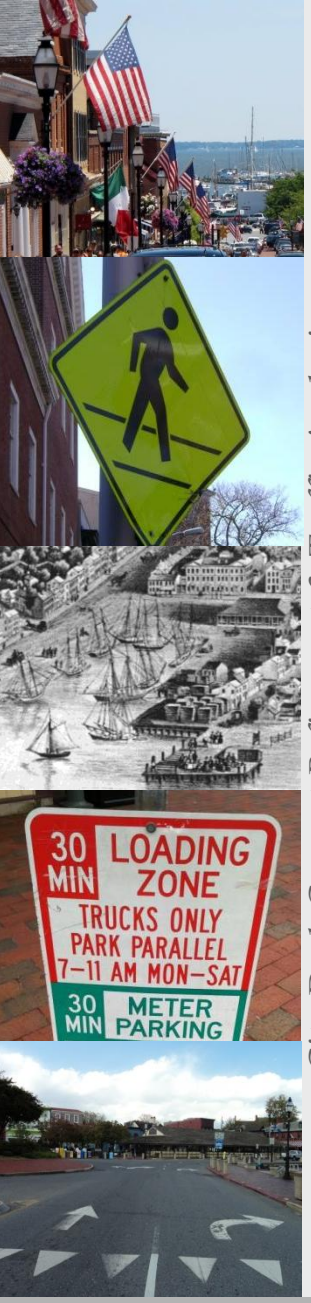


Main St. at Randall St. – early 1800's



Main St. at Randall St. – circa 1880

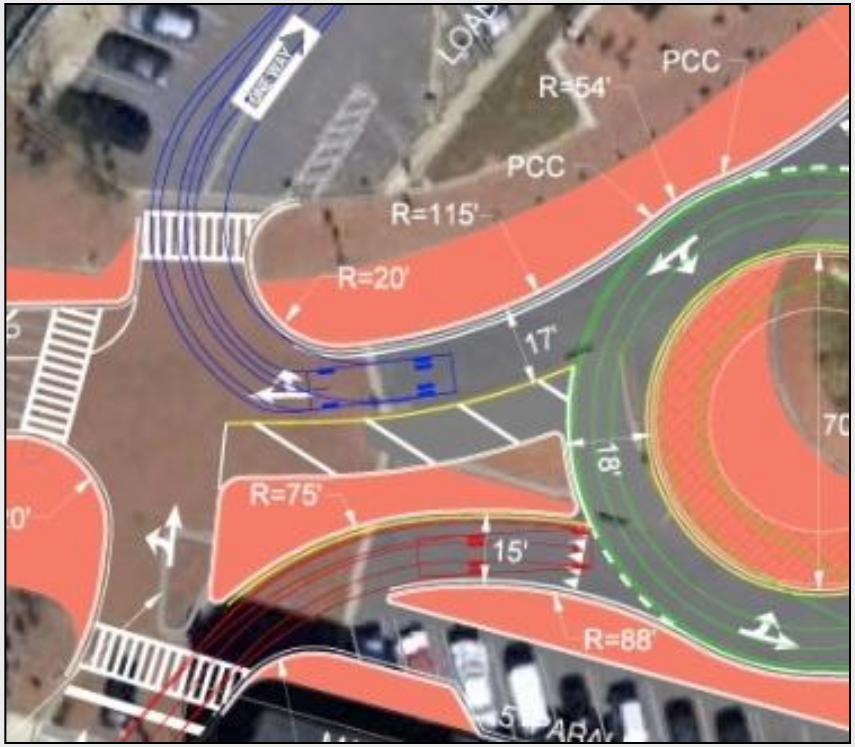


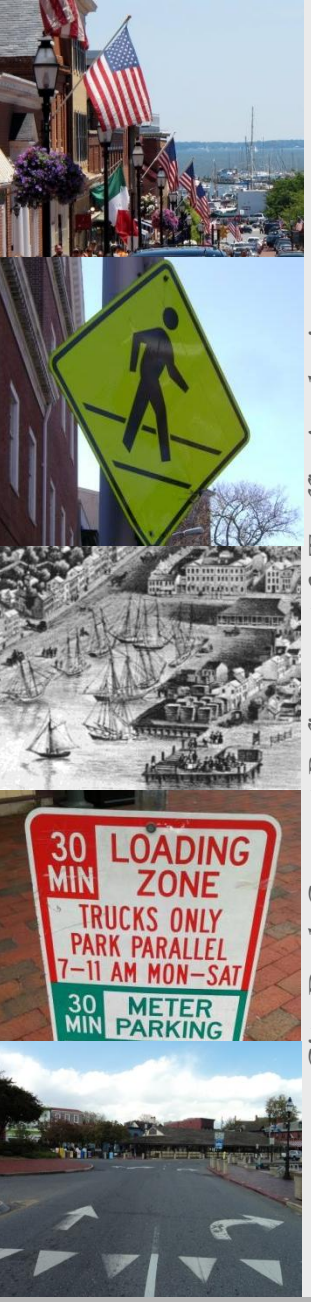


Option 1 – Business Access

Pros

- Enhanced pedestrian access invites more potential customers to area
- Mostly maintains existing truck circulation patterns for loading

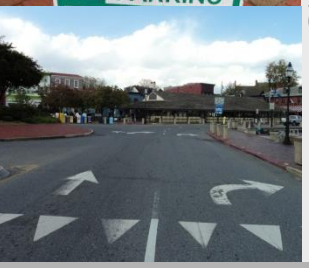




Option 1 – Business Access

Cons

- Reduction in linear feet of loading space from approximately 725’ to 480’
- Parking shifted away from businesses at foot of Main St between Green St and Compromise St (net loss of only 1 parking space)



City Dock Concept Refinement & Traffic Analysis

Option 1 – Traffic Operations

Pros

- Reduces congestion during week*end* peak periods while preserving roadway capacity for week*day* peak flows

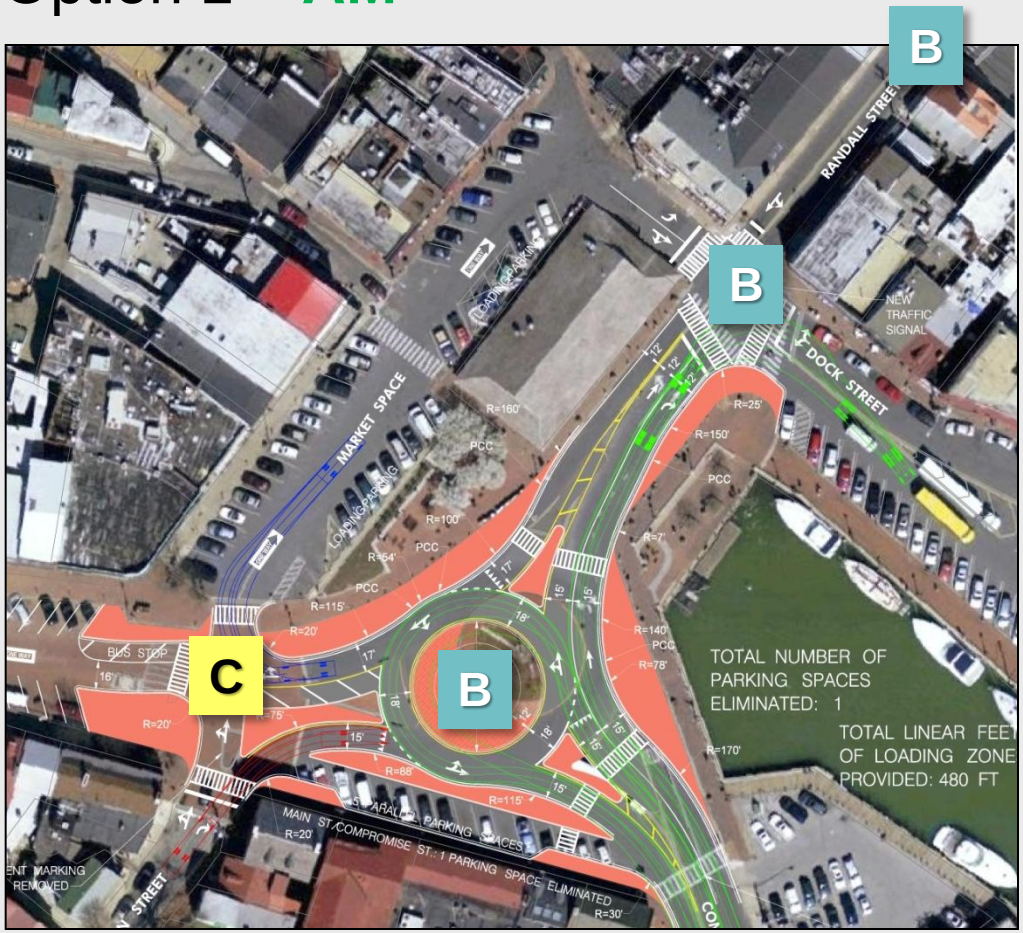
Cons

- Pedestrian / motorist interactions on roundabout crosswalks still have potential to create significant delays during weekend peak periods

City Dock Concept Refinement & Traffic Analysis

Operational Analysis

Option 1 – AM

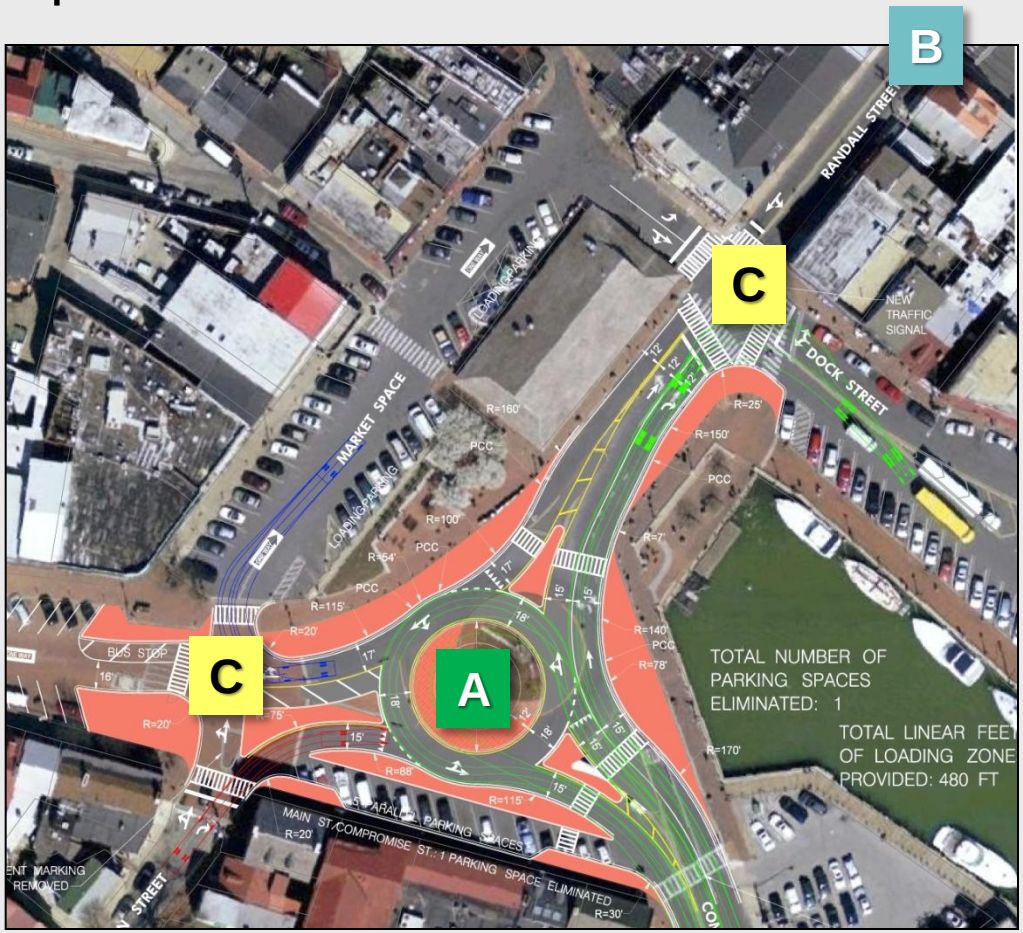


	Avg. Delay
A	≤ 10 sec
B	≤ 20 sec
C	≤ 35 sec
D	≤ 55 sec
E	≤ 80 sec
F	> 80 sec

City Dock Concept Refinement & Traffic Analysis

Operational Analysis

Option 1 – PM



Avg. Delay	
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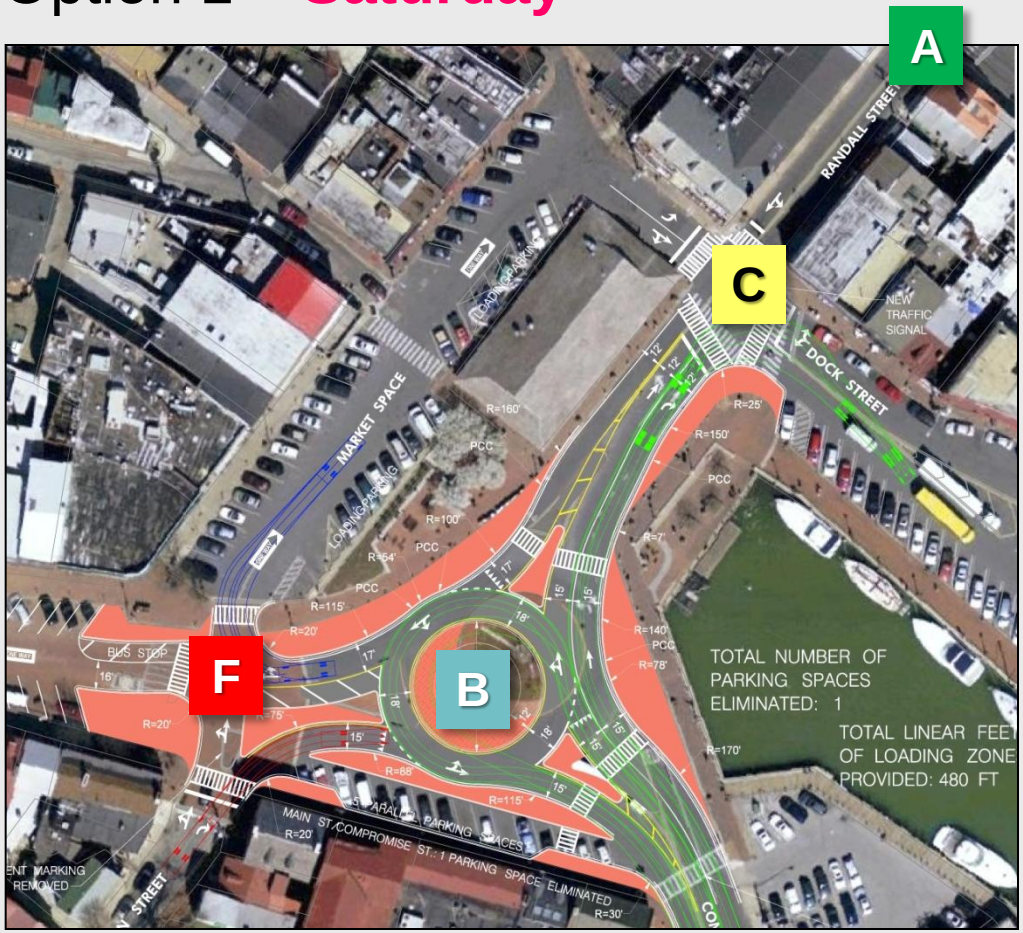
City Dock Concept Refinement & Traffic Analysis

Operational Analysis

Option 1 – Saturday



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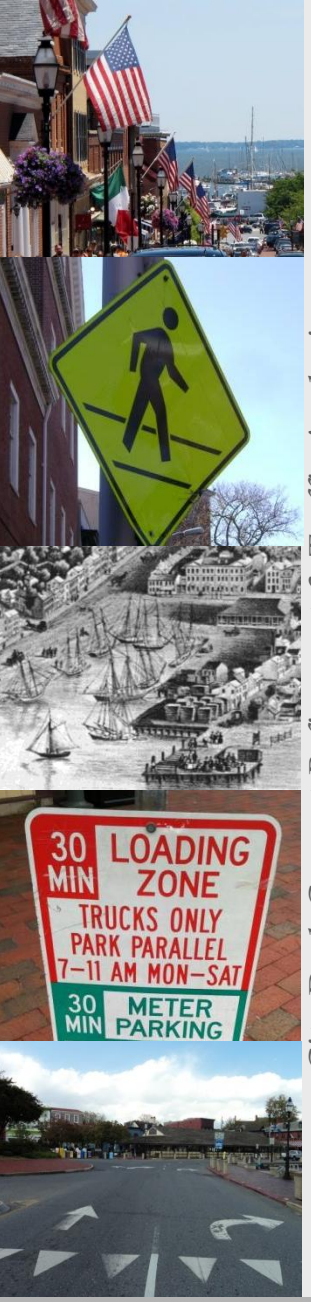
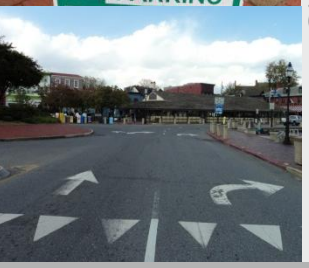


VISSIM Simulation – Option 1 Saturday



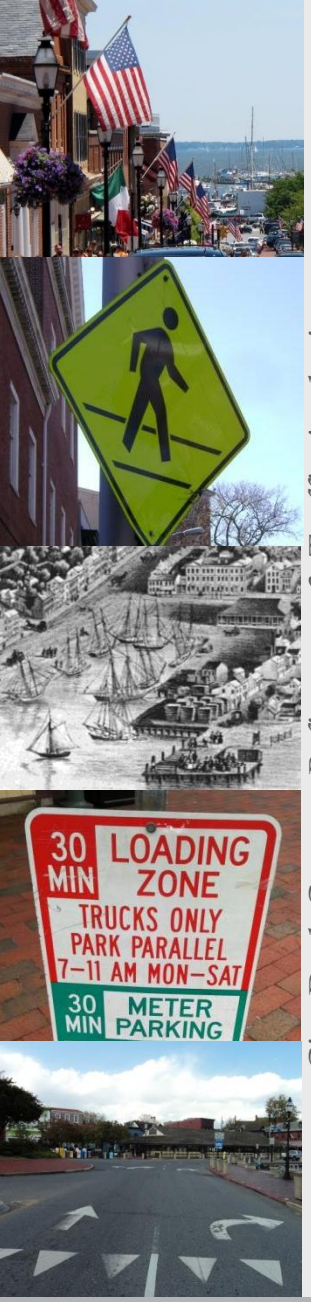
City Dock Concept Refinement & Traffic Analysis

Option 2a – Public Space & Access

Pros

- Maximizes creation of public space adjacent to the waterfront
- Signals with short cycle lengths and all-pedestrian phasing provide gaps for both vehicles and pedestrians to move
- Mid-block signal near Market House accommodates strong pedestrian desire line

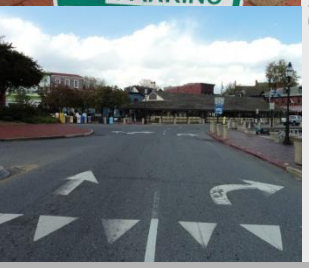
- Pedestrian delay may be reduced significantly on weekends for careful pedestrians who wait for gaps in traffic



Option 2a – Public Space & Access

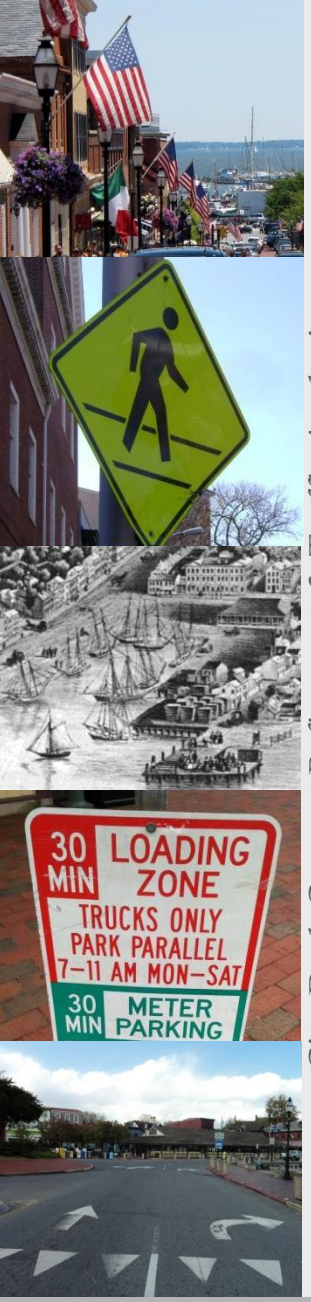
Cons

- Pedestrian delay could increase somewhat for aggressive weekend pedestrians and their "followers"
- Pedestrian delay could increase for compliant pedestrians during off-peak when gaps are available



City Dock Concept Refinement & Traffic Analysis

Option 2a – Public Space & Access

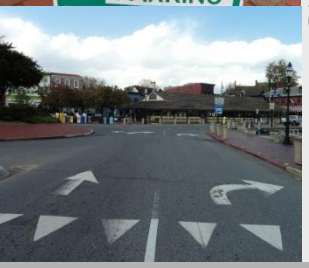


Option 2a – Safety

Pros

- Signal control allows greater flexibility for managing pedestrian/vehicular conflicts
- All-pedestrian signal phases eliminate conflicts for compliant pedestrians during peak pedestrian periods (PM & Saturday)
- Advanced walk signals improve safety at other times
- Geometry requires right turners to slow down in advance of crosswalks more than existing conditions

- Likely to improve *perception* of safety, which can be critical for good business

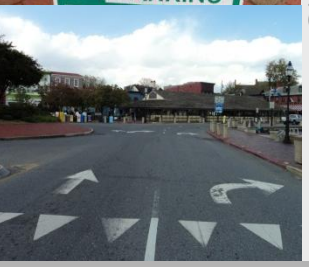


City Dock Concept Refinement & Traffic Analysis

Option 2a – Safety

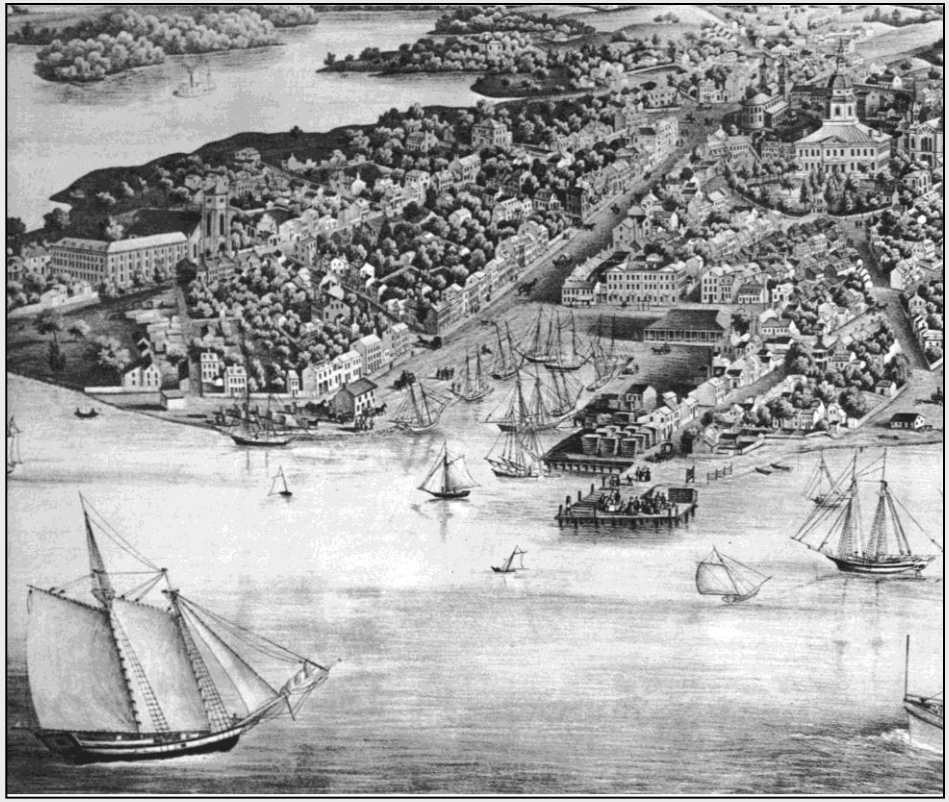
Cons

- Signals could slightly reduce *actual* safety in other ways since drivers sometimes don't see signals and pedestrians sometimes don't look both ways (Main St at Conduit St: 4 crashes 2007-2009)
- But... other factors limit speed & should help mitigate this effect



City Dock Concept Refinement & Traffic Analysis

Option 2a – Aesthetics

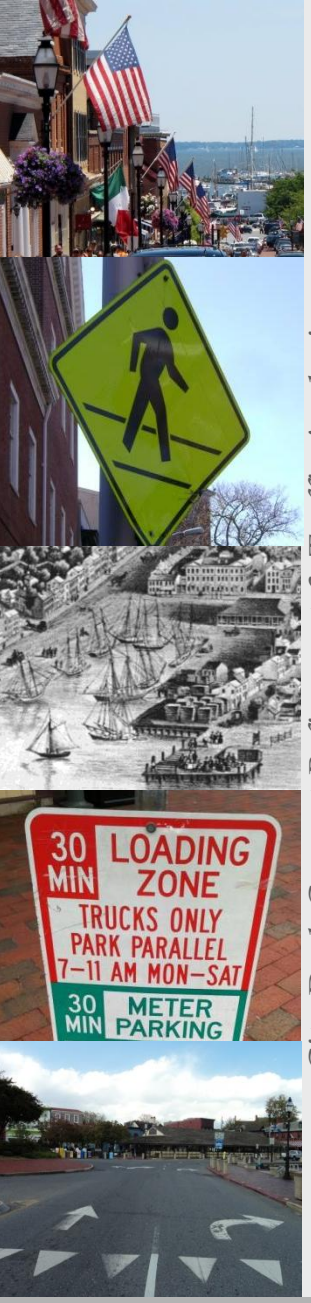


Pros

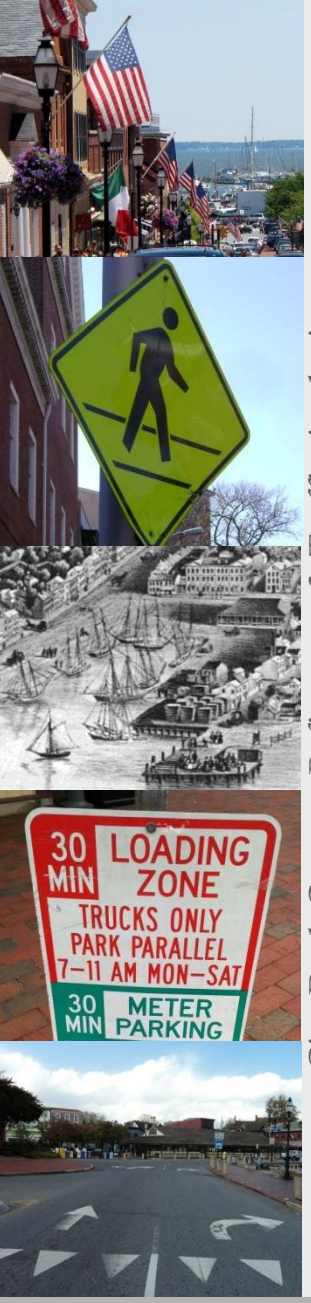
- Consistent with 18th and 19th century form of street network

Cons

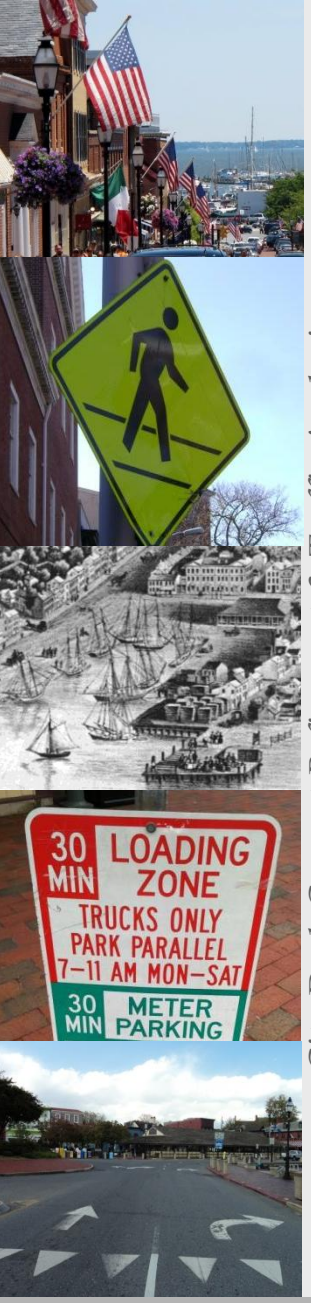
- Signals facing southbound Main St (after right turn from Green St) could impact view shed slightly



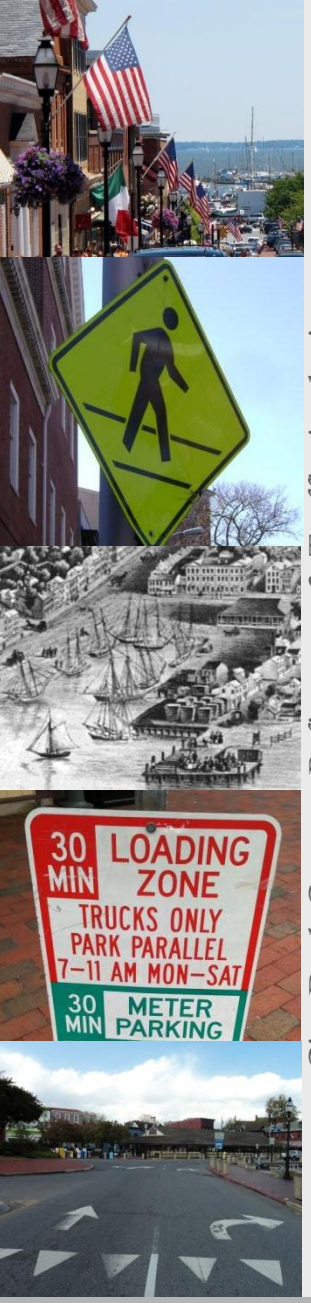
Option 2a – View from above Conduit St



Option 2a – View from above Conduit St

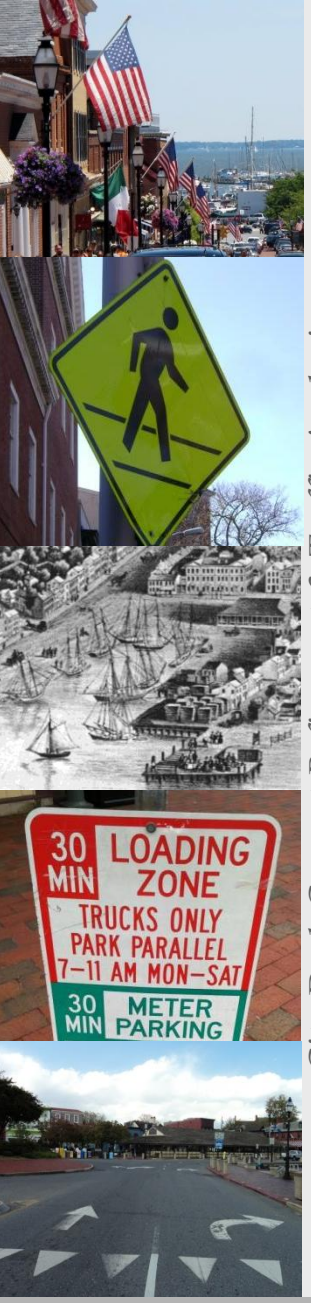


Option 2a – View at Conduit St

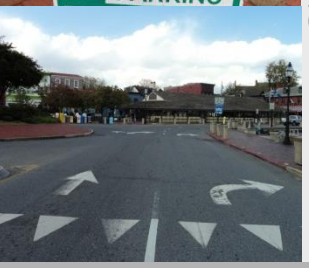


Option 2a – View from near Green St

Option 2a – View from near Green St



Option 2a – View from foot of Main St



City Dock Concept Refinement & Traffic Analysis

Option 2a – Business Access

Pros

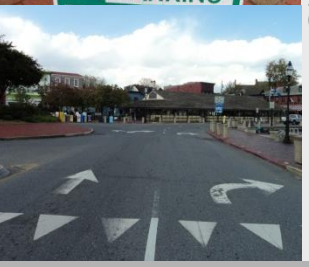
- Enhanced public space & less traffic congestion invites more potential customers to area & increases duration of visits

Cons

- Reduction in linear feet of loading space from approximately 725’ to 500’
- 6 parking spaces eliminated

Cons (cont’d)

- Additional delay during weekday peak hours could harm a few businesses that rely on “pass-by” trips if cut-through commuters divert to other routes
- Trucks entering via Compromise St would have to exit via Main St instead of U-turning



Option 2a – Traffic Operations

Pros

- Reduces congestion significantly during peak weekend periods
- Preserving space for left turn lane to Compromise St results in less congestion and/or more opportunity for all-pedestrian phasing

Cons

- Right turn lane to Dock St is removed
- Delay would increase slightly during off-peak hours and significantly during weekday peak hours, but not to extreme levels

City Dock Concept Refinement & Traffic Analysis

Operational Analysis

Option 2a – **AM**

	Avg. Delay
A	≤ 10 sec
B	≤ 20 sec
C	≤ 35 sec
D	≤ 55 sec
E	≤ 80 sec
F	> 80 sec

City Dock Concept Refinement & Traffic Analysis

Operational Analysis

Option 2a – PM

	Avg. Delay
A	≤ 10 sec
B	≤ 20 sec
C	≤ 35 sec
D	≤ 55 sec
E	≤ 80 sec
F	> 80 sec

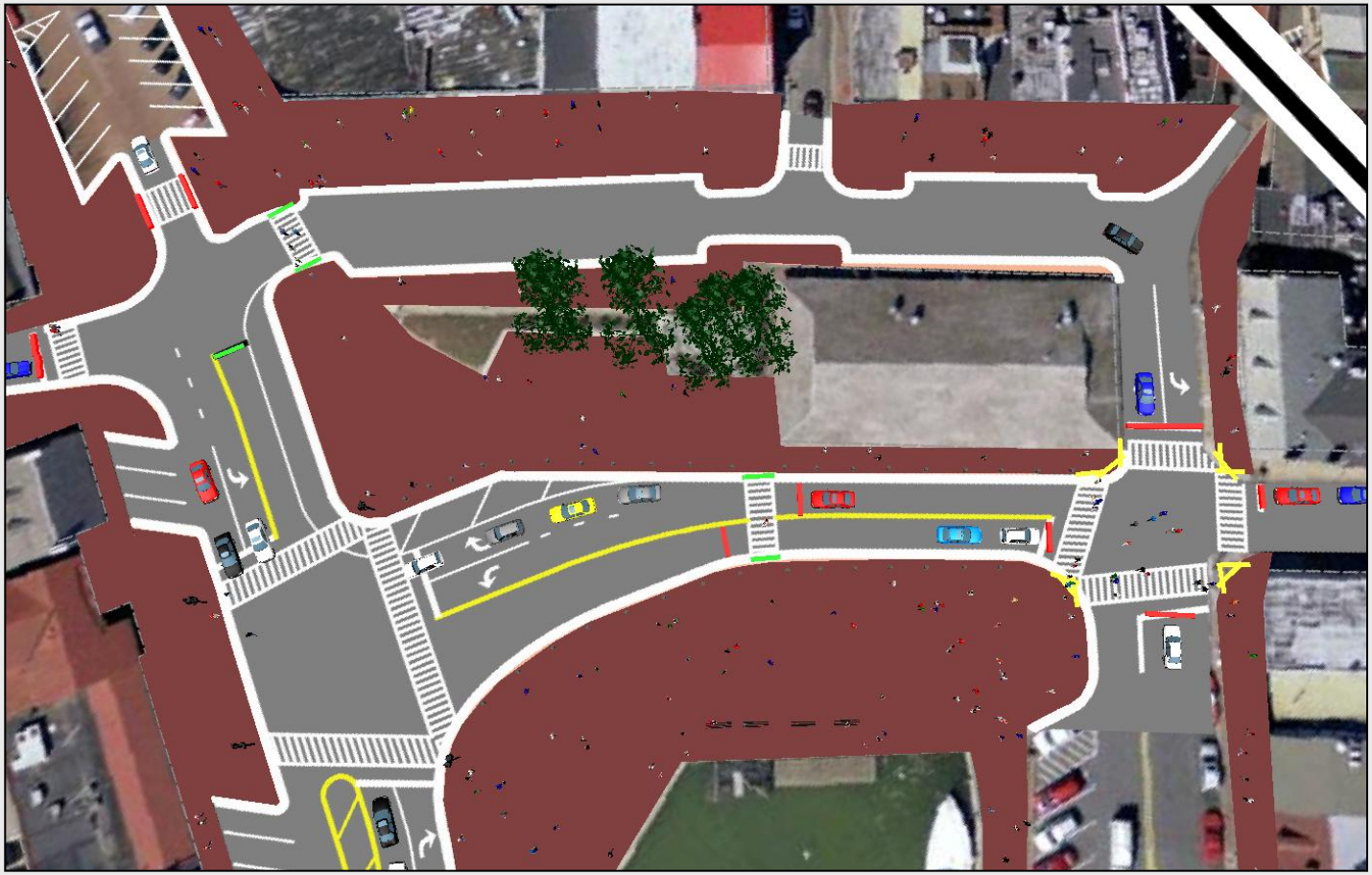
City Dock Concept Refinement & Traffic Analysis

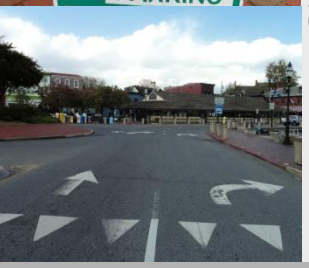
Operational Analysis

Option 2a – **Saturday**

	Avg. Delay
A	≤ 10 sec
B	≤ 20 sec
C	≤ 35 sec
D	≤ 55 sec
E	≤ 80 sec
F	> 80 sec

VISSIM Simulation – Option 2a Saturday





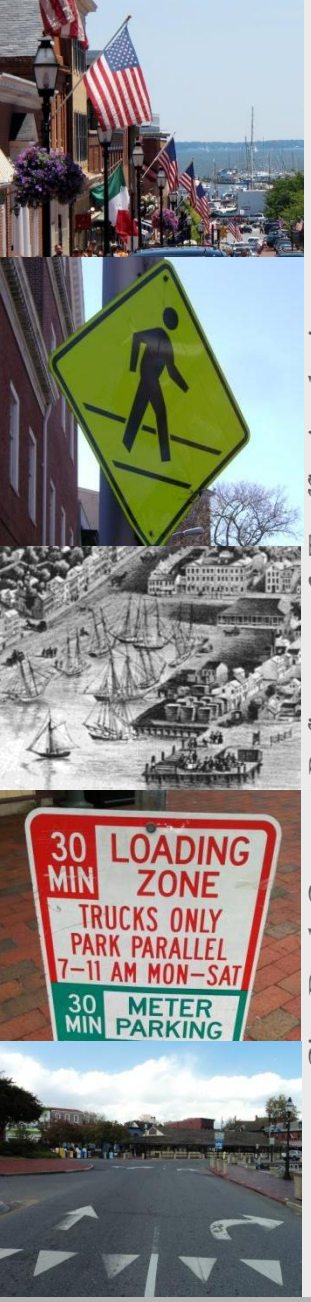
City Dock Concept Refinement & Traffic Analysis

Option 2b – Public Space & Access

Pros

- Creates moderate amount of additional public space
- Signals with short cycle lengths and all-pedestrian phasing as with Option 2a
- Intersection location places crosswalks on strong pedestrian desire line near Market House

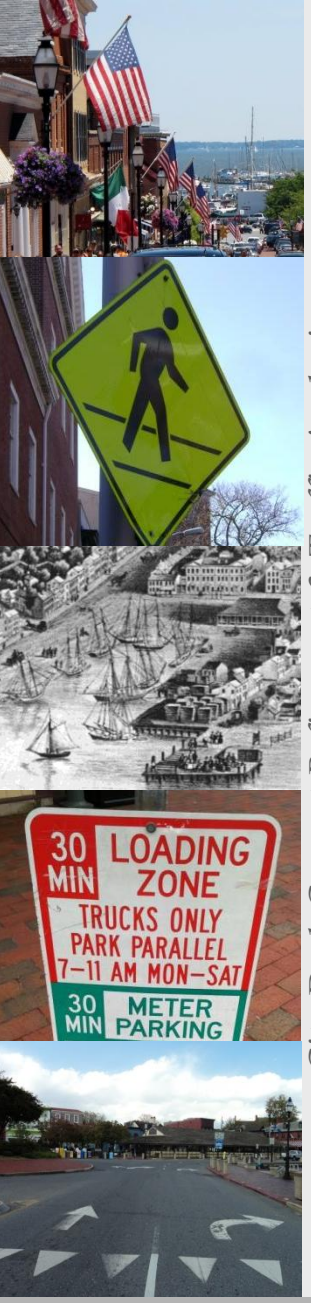
- Pedestrian delay similar to Option 2a (reduced significantly on weekends for careful pedestrians, increased delay for other pedestrians & at other times)



Option 2b – Public Space & Access

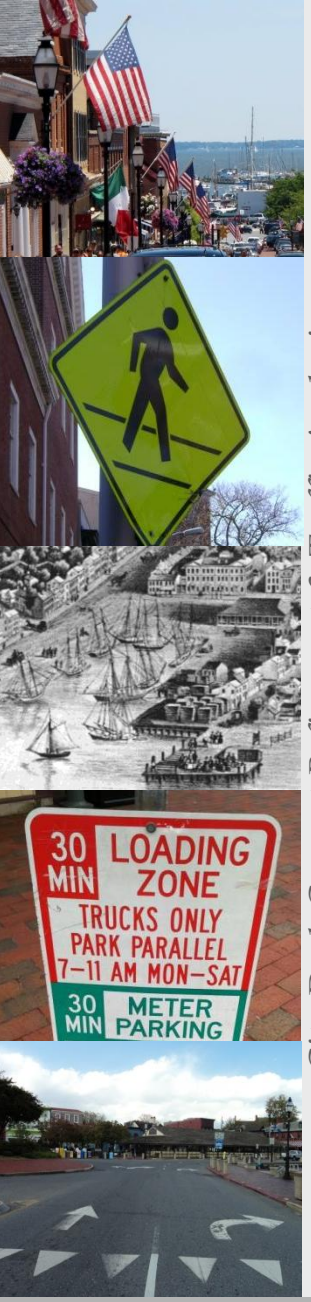
Cons

- Less public space created near water than with Option 2a… more space "land-locked"
- Care should be taken that any landscaping or other features in new triangular island does not block existing or potential viewshed



City Dock Concept Refinement & Traffic Analysis

Option 2b – Public Space & Access



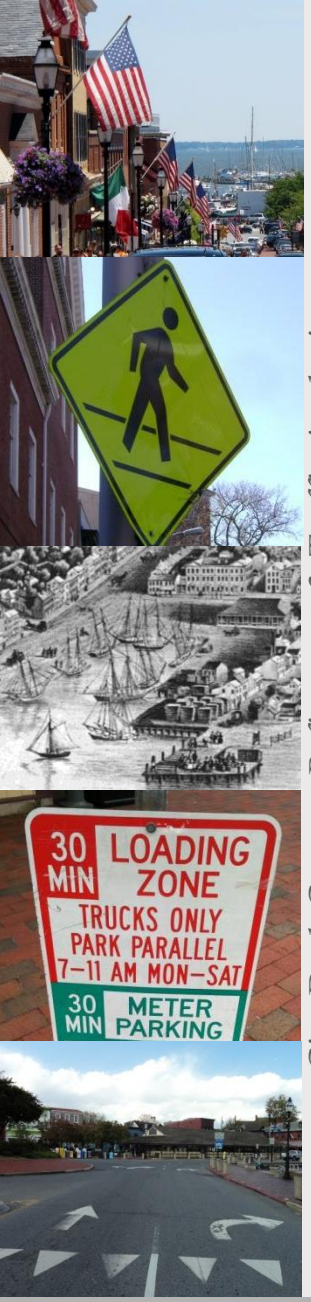
Option 2b – Safety

Pros

- All-pedestrian signal phases eliminate conflicts for compliant pedestrians during peak pedestrian periods (Saturday)
- Advanced walk intervals improve safety at other times
- Like Option 2a, likely to improve *perception* of safety, which can be critical for good business

Cons

- Geometry does not limit speeds as much as in Option 2a
- Like Option 2a, signals could slightly reduce *actual* safety
- All-ped phase limited in PM



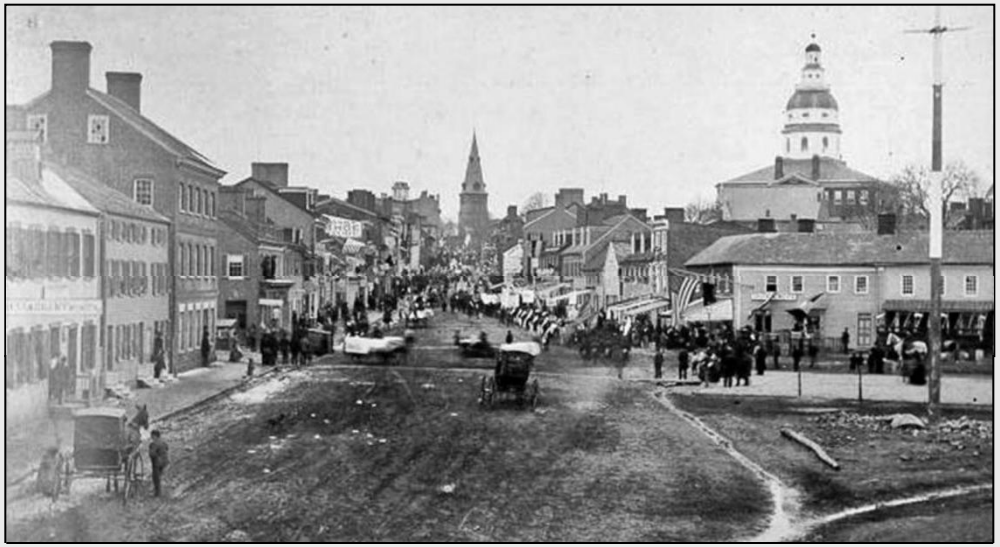
Option 2b – Aesthetics

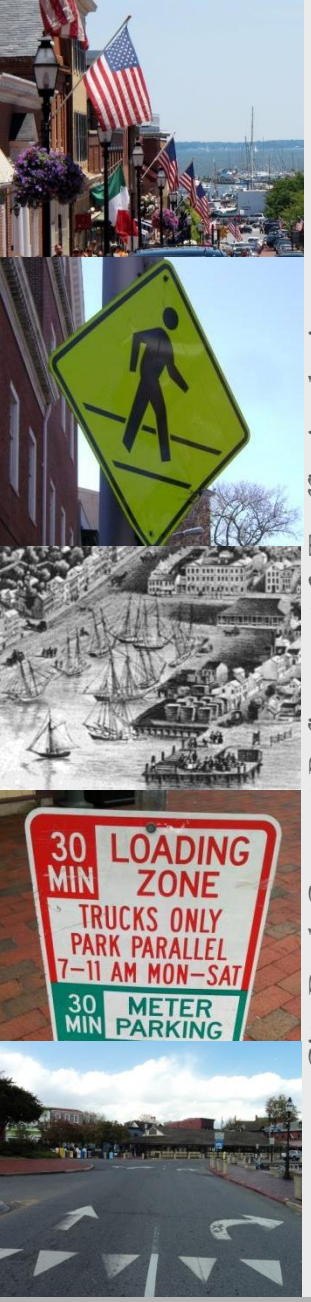
Pros

- Alignment of intersection removes signal faces from Main St viewshed

Cons

- Intersection form only somewhat similar to that of late 1800's



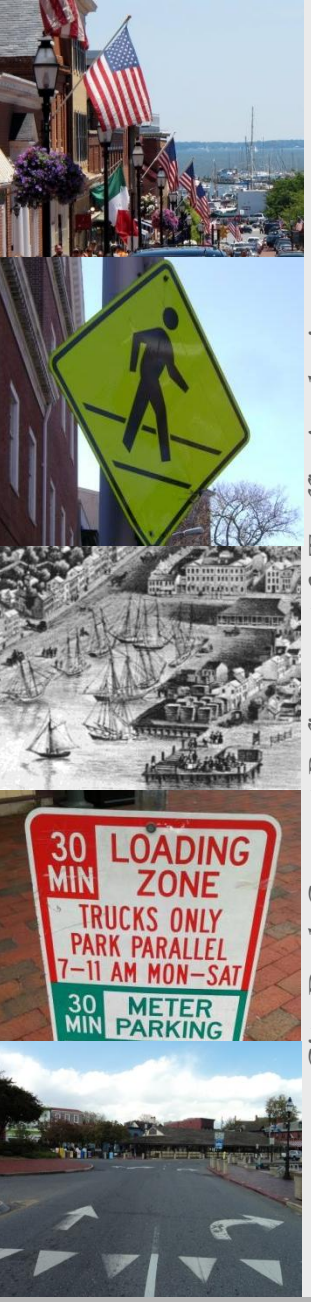


Option 2b – Business Access

Pros

- Enhanced public space and reduced traffic congestion invites more potential customers to area and increases duration of visits, but potentially less so than Option 2a
- Provides more loading space (540') than other options

- Adds 8 new on-street parking spaces

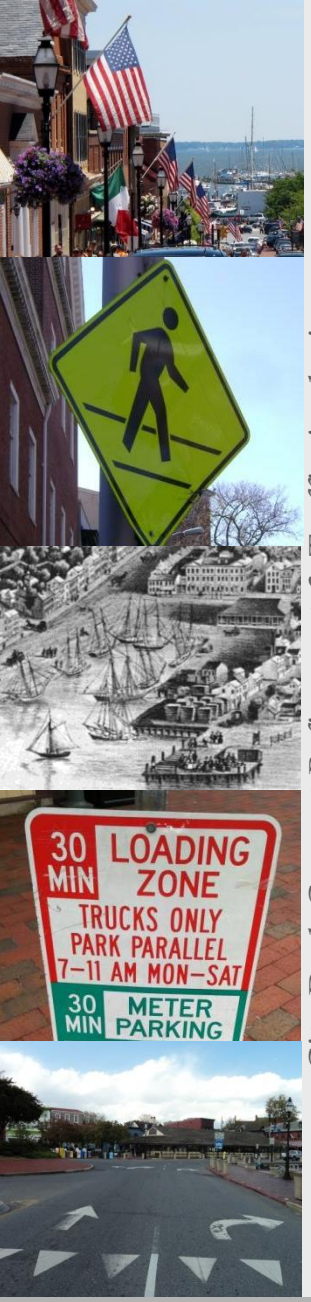


Option 2b – Business Access

Cons

- Weekday peak hour "pass-by" diversion as in Option 2a
- Trucks entering via Compromise St would have to exit via Main St as in Option 2a
- Even small trucks would have difficulty turning right into Market Space
- Service road intersection with Green St introduces unusual geometry & conflicts

- Service road in front of liquor store can only be accessed via left turns from Compromise St, which could induce cut through traffic



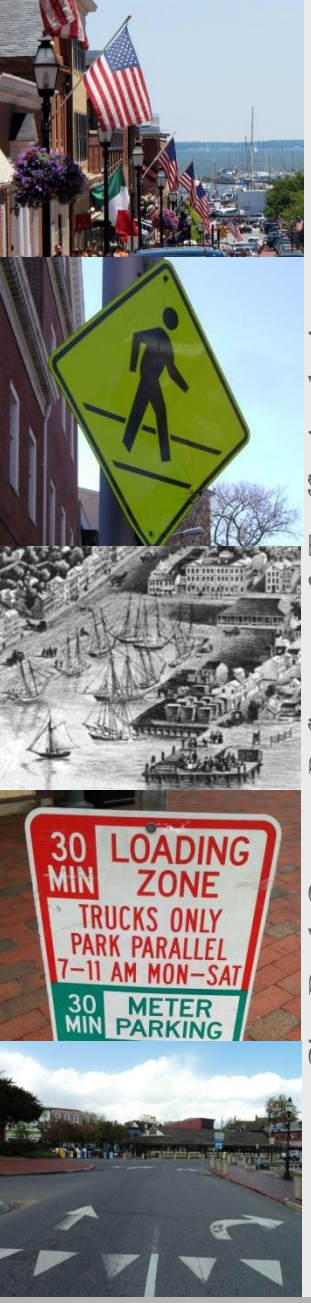
Option 2b – Traffic Operations

Pros

- Reduces congestion significantly during peak weekend periods, but less so than Option 2a due to lack of left turn lane to Compromise St

Cons

- Similar to Option 2a, delay would increase slightly during off-peak hours & significantly during weekday hours
- But, with no exclusive left turn lane to Compromise St, impact would be worse, especially in PM



City Dock Concept Refinement & Traffic Analysis

Operational Analysis

Option 2b – AM

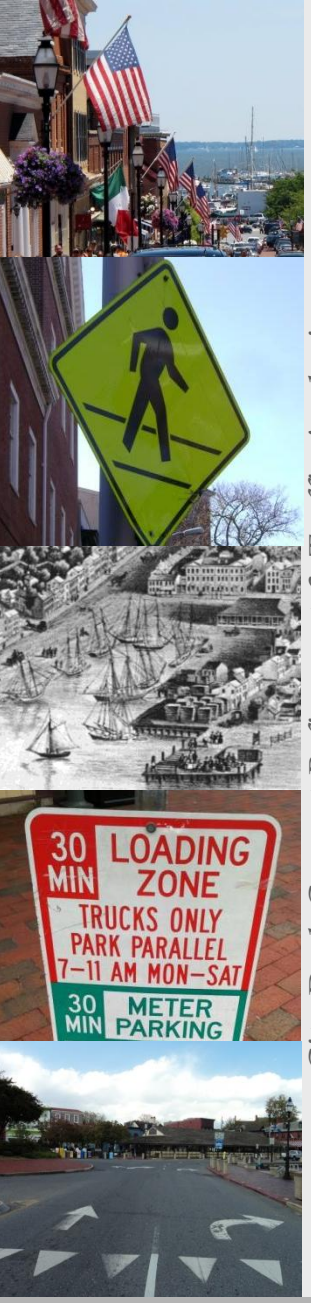
	Avg. Delay
A	≤ 10 sec
B	≤ 20 sec
C	≤ 35 sec
D	≤ 55 sec
E	≤ 80 sec
F	> 80 sec

City Dock Concept Refinement & Traffic Analysis

Operational Analysis

Option 2b – **PM**

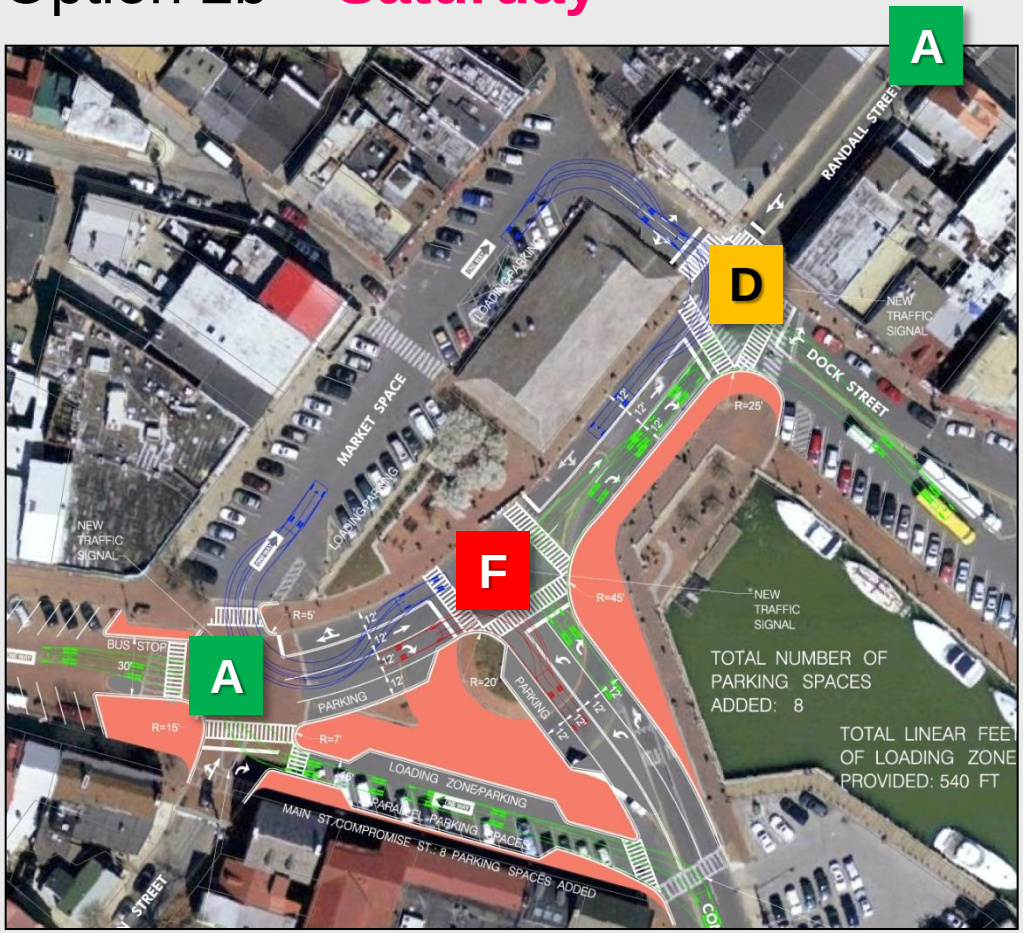
	Avg. Delay
A	≤ 10 sec
B	≤ 20 sec
C	≤ 35 sec
D	≤ 55 sec
E	≤ 80 sec
F	> 80 sec



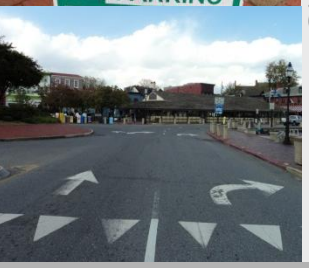
City Dock Concept Refinement & Traffic Analysis

Operational Analysis

Option 2b – **Saturday**

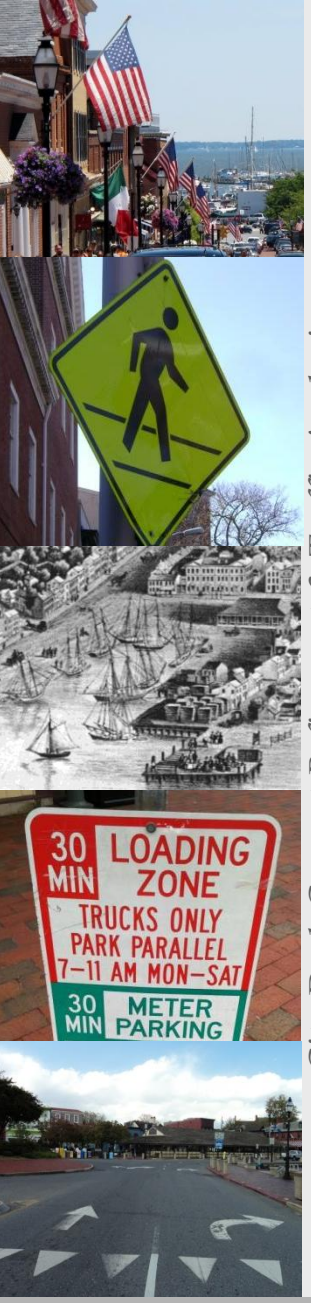


	Avg. Delay
A	≤ 10 sec
B	≤ 20 sec
C	≤ 35 sec
D	≤ 55 sec
E	≤ 80 sec
F	> 80 sec



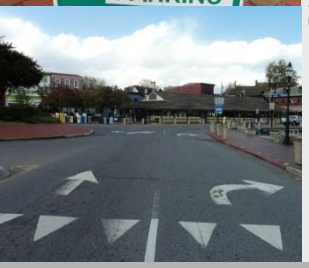
Findings

- **Public Space & Access:** Option 2a best
- **Safety:** Options similar in terms of actual safety, but Option 1 slightly better
  - Option 2a or 2b best in terms of "*perceived* safety"
- **Aesthetics:** "…in the eye of the beholder…"
  - Option 1 matches 20th Century form
  - Option 2a matches 18th & early 19th century & Option 2b matches late 19th



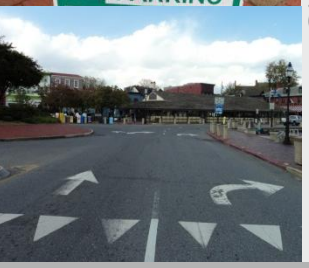
Findings

- **Business Access:**
  - Options 1 and 2a have similar minor reductions in on-street parking (1 vs. 6)
  - Options 1 and 2a have similar changes to loading zone space that could be mitigated by adding loading zone hours in afternoon
  - Option 2b adds 8 parking spaces & minimizes reduction of loading space but is most disruptive to loading patterns



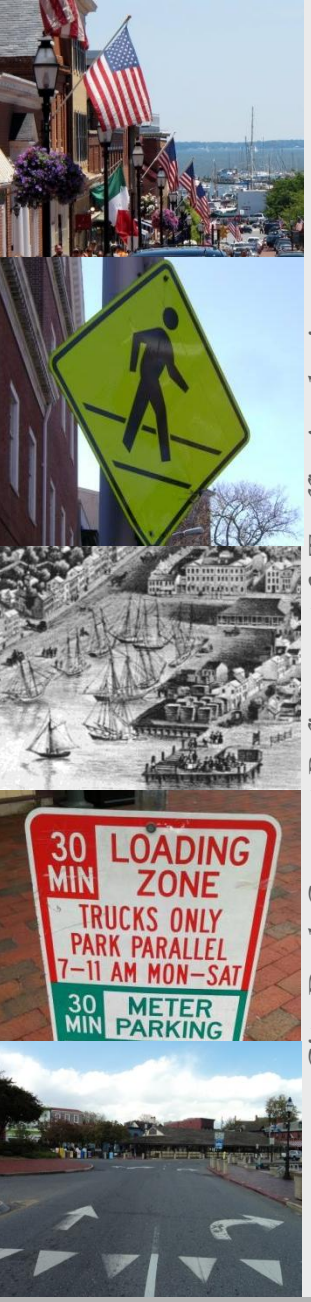
Findings

- **Traffic Operations:**
  - Option 1 – best letter grades (especially if modified to reduce parking further or include signal at Main St & Green St)
  - Option 2a – shortest backups (longer backups in Option 1 due to continued lack of driver & pedestrian discipline)
  - Pedestrians – short crossing distances and signal control provide more comfortable pedestrian experience
  - Bicycles – Intersection design more compatible with safe bicycle operation



Summary of Next Steps

- Preferred alternative selection
- More detailed (afternoon) parking inventories
- Lighting
- Public Art
- Permitting/ Stormwater Management
- Detailed Landscaping/ Streetscaping/ Bioretention
- Construction Cost
- Construction Sequencing



Questions & Answers

Thank You!