Report for the
Wisconsin Department of Transportation

Business 51 Circulation Study

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SECTION 1
INTRODUCTION

1.01 LOCATION

The Business 51 Internal Circulation Study evaluates a variety of traffic flow issues within Wausau's Central Business District (CBD). This study compliments and appends a previous study that dealt only with the Washington Street/1st Street intersection. The broad study area of this report is bounded by McIndoe Street, 6th Street, Thomas Street, and 1st Street with the Wisconsin River to the west. The area is shown in Figure 1.01-1.

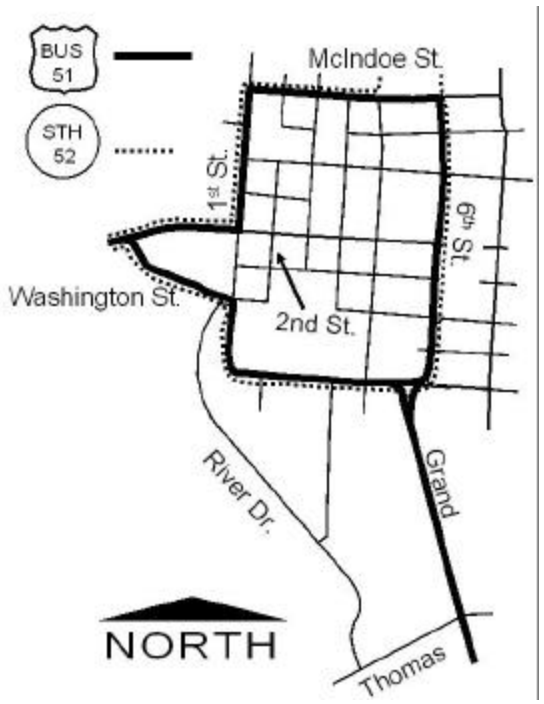


Figure 1.01-1 Study Area

1.02 BACKGROUND

A. General

In 1999, the City of Wausau developed a CBD Master Plan to encourage the continued economic health of Wausau's City Center. The Master Plan proposed a number of measures to encourage redevelopment, enhance aesthetics in the CBD, and improve traffic flow. This report evaluates some of the transportation recommendations proposed by the CBD Master Plan. These measures include converting several one-way streets to two-way operation, changing parking configurations on several streets, and changing the operation of several intersections.

Figure 1.02-1 Land Uses in Study Area

B. Land Use

The Wausau CBD houses a variety of retail and commercial uses. Land uses include recreational uses, cultural, and large mall retail. The CBD also includes city and county government. There are also residential land uses in the northern and eastern borders of the study area. The City of Wausau desires to continue and enhance the CBD's

role in recreational, cultural, residential, retail, entertainment, office, and government uses. As part of the CBD Master Plan, the City is considering efforts to encourage new business enterprises, including high-tech businesses, a convention center and hotel, and possibly a museum. Figure 1.02-1 shows an aerial photograph of the area roughly showing land use density.

B. Existing Transportation Network

The study area has a series of one-way streets intermingled with two-way streets. Currently Scott Street and the Washington/1st/Forest Street combination serve as a one-way pair for east/west travel. Similarly, 5th and 6th Streets function as a one-way pair for north/south travel. These two one-way pairs carry the majority of traffic traveling through the study area.

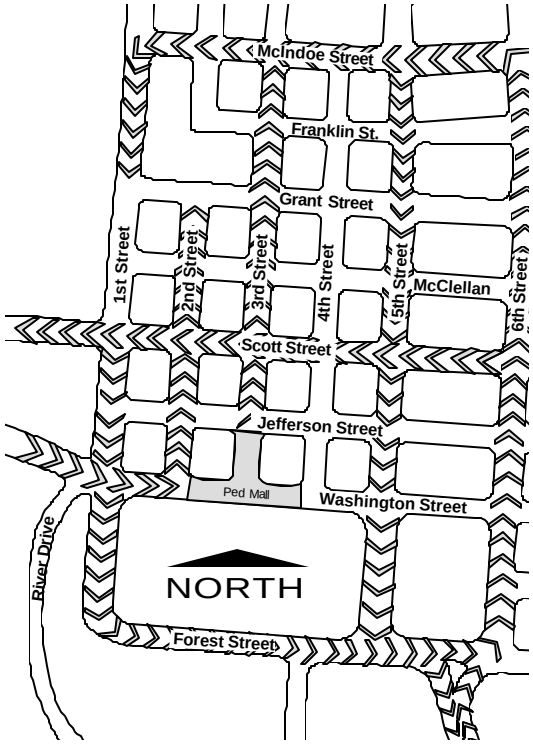


Figure 1.02-2 One-Way Street System

Other one-way streets in the study area do not provide a substantial mobility function but rather distribute travelers to local destinations. These streets include:

- 1st Street, which is one-way southbound except for the portion between Scott and Grant Streets, which is two-way.

- 2nd Street, which is one-way northbound and currently helps distribute traffic through the downtown. Eastbound traffic on Washington Street bends and travels north on 2nd street before turning onto Jefferson and other CBD cross streets. (See Figure 1.02-3)

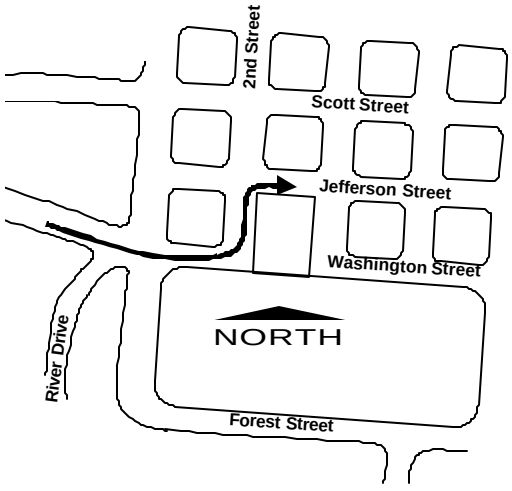


Figure 1.02-3 CBD Distribution

- 3rd Street, which is one-way northbound and serves a retail line of businesses with angle parking.

- McIndoe Street, which is a one-way westbound street.

Figure 1.02-2 depicts the one-way street system in the CBD.

Figure 1.02-4 illustrates average daily traffic (ADT) volumes on streets throughout the CBD. The figure shows that Scott and the Washington/1st/Forest Street combination carry the majority of east/west traffic while 5th and 6th Streets carry the majority of north/south traffic. The northern portion of the study area of the CBD has lower ADTs, with the exception of 6th Street. On 4th Street, the ADT is as low as 870 vehicles per day.

C. Peak Period Information

For most of intersections counted, the evening peak traffic hour of the day was generally from 4:30 to 5:30 P.M. With the morning peak period being from 7:30 to 8:30 P.M. In general, the evening rush hour traffic volumes were 50 percent greater than the morning rush hour traffic volumes.

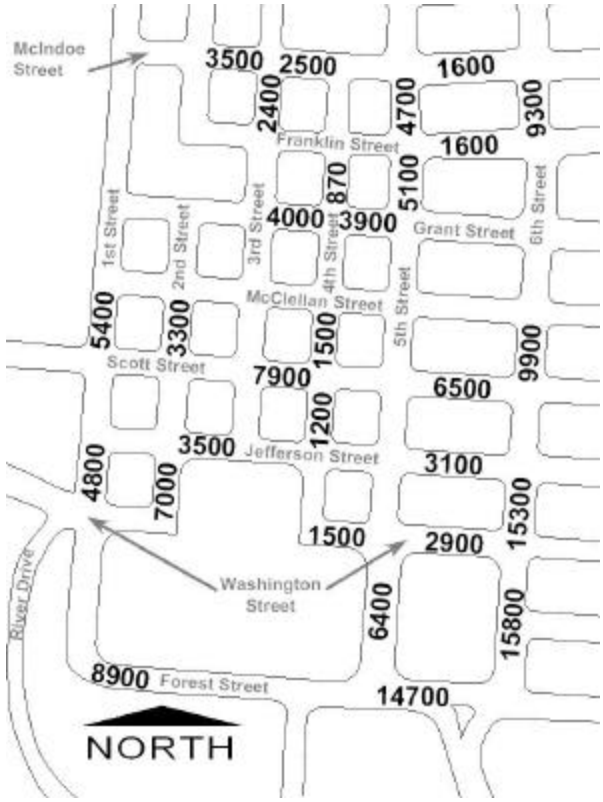


Figure 1.02-4 1998 Wisconsin DOT ADTs in the CBD

1.03 REPORT PURPOSE

As mentioned, this report evaluates many of the transportation recommendations contained in the CBD Master Plan. The following bullets list the topics that this report will specifically evaluate and what section they are addressed in.

- The conversion of 1st Street from one-way to two-way operation (Section 2).
- The conversion of 2nd Street from one-way to two-way operation (Section 3).
- The conversion of 3rd Street from one-way to two-way operation as well as an evaluation of angle vs. parallel parking (Section 4).
- The conversion of McIndoe Street from one-way to two-way operation (Section 5).
- The conversion of Jefferson Street from two-way to one-way operation (Section 6).
- The operation of the Grant and Thomas Street intersection and the River and Thomas Street intersection (Section 7).
- The intersection radii of the Washington and 2nd Street intersection (Section 8).

SECTION 2
1ST STREET

2.01 BACKGROUND

1st Street runs north/south parallel to the Wisconsin River and is the western boundary of the study area. In the study area it is both a one-way and a two-way street. The one-way street portions travel southbound and are between McIndoe Street and Grant Street and then again south of Scott Street to 1st Street's transition to Forest Street. Between Grant Street and McIndoe Street, 1st Street is a two-way street. Figure 2.01-1 schematically illustrates the lane configurations and lane markings for 1st Street. The average daily traffic (ADT) is 4,800 to 5,400 vehicles per day.

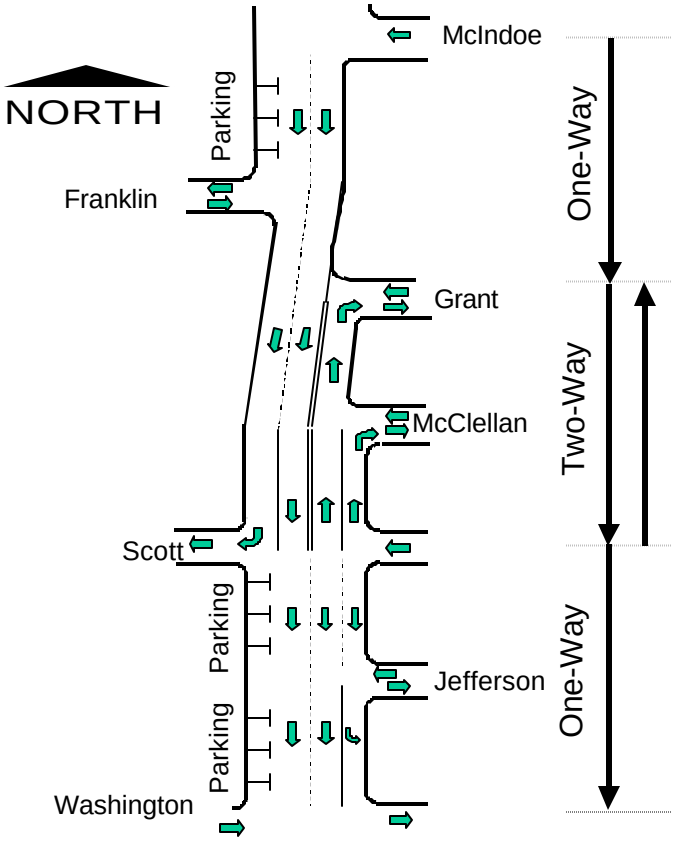


Figure 2.01-1 1st Street Existing Lane Configurations

The City's CBD Master Plan recommends converting 1st Street to two-way operation between Washington Street to Scott Street. The Master Plan cites the importance of 1st Street as a connection to the redevelopment areas along the river as the reason for the conversion. The master plan further recommends renaming 1st Street to River Drive (north of Washington Street) to highlight its new role as a primary riverfront access corridor.

Some of these changes have already been acted upon by the city. The Scott Street/1st Street intersection has new signal heads facing both directions, even though the street remains one-way in this section.

2.02 ISSUES

The conversion of 1st Street from one-way to two-way operation specifically addresses how traffic that enters from the west is distributed through the CBD. Currently this traffic must travel east on Washington Street past 1st Street and then bend north on 2nd Street. Once on 2nd Street, this traffic is distributed through the downtown area. Because all CBD-destined traffic coming from the west must use this route, there have been complaints about the awkward

turning radii at the Washington Street/2nd Street intersection and the 2nd Street/Jefferson Street intersection.

Converting 1st Street to two-way operation north of Washington Street allows 1st Street to distribute CBD-destined traffic that originates from the west. Therefore, changing 1st Street to two-way operation increases the role 1st Street plays in downtown traffic circulation. Figure 2.02-1 illustrates the existing and proposed routing. This routing change would be a paradigm shift for current travelers who are accustomed to using 2nd Street to access the CBD. There is no reason, however, that this distribution could not work as well as the current routing.

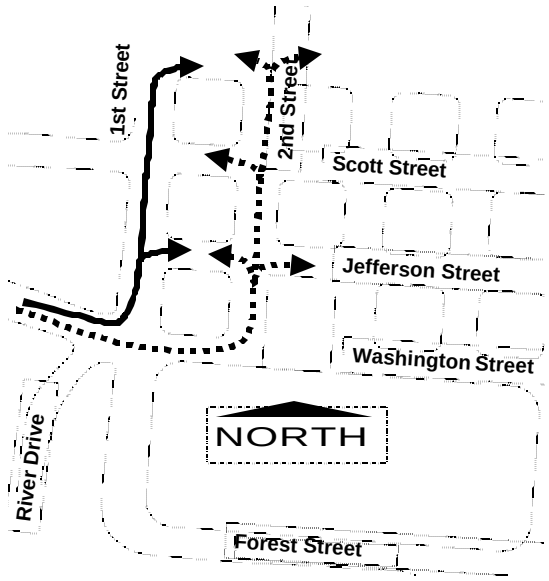


Figure 2.02-1 Downtown Traffic Distribution

2.03 ALTERNATIVES

The study team developed three alternatives for 1st Street. One alternative allows 1st Street to continue as a one-way street with a small two-way portion between Scott Street and Grant Street. The other two alternatives allow two-way traffic on 1st Street for its entire length. The basic difference between these two alternatives is the number of lanes provided for traffic. With both of the 2-way alternatives for 1st Street, the traffic control for 2nd Street would change. 2nd Street would have stop signs that give priority to the east-west streets. Giving east-west streets free flow movement allows 1st Street to more effectively distribute traffic to the CBD (see Section 3 for 2nd Street discussion).

The following paragraphs describe each alternative in more detail.

A. Alternative 1 – Existing Conditions (No Build)

Alternative 1 maintains the existing lane and traffic flow configuration described in Section 2.01 and illustrated in Figure 2.01-1. With the existing conditions alternative, one-way traffic operation is maintained between Scott Street and Forest Street and between McIndoe Street and Grant Street. Two-way operation is maintained between Grant Street and Scott Street.

B. Alternative 2 – Two-way Operation without Geometric Changes

Alternative 2 allows two-way traffic on the existing facility without any geometric changes. Four lanes (two lanes southbound and two lanes northbound) would be created between Washington Street and McClellan Street by simply restriping the roadway and eliminating parking. The roadway in this section is already wide enough for four 11-foot lanes of traffic (with 2 feet

reserved on each side for gutters). The northbound right lane would be dropped at McClellan Street as a right-turn only lane in order to accommodate the narrower width north of McClellan Street. The current 40-foot width between McClellan Street and Grant Street will allow only three lanes of traffic. This segment must be restriped to allow northbound traffic to shift to the existing lanes north of Grant Street (see Figure 2.03-1). The existing roadway between Grant Street and McIndoe Street will only accommodate two travel lanes (one north- and southbound lane) without widening the roadway. Southbound traffic would get a second lane between Grant Street and McClellan Street once there is enough room for the three lanes. The intersection of 1st and McIndoe Streets would require a different traffic control configuration. Three traffic control configurations are possible. Currently, traffic moving westbound to southbound is not required to stop. To keep this movement as a priority movement, north- and southbound traffic would need to be stop-controlled. Another possibility is to stop westbound traffic on McIndoe Street and allow north- and southbound traffic to flow freely. One final control option would be to fully stop-control the intersection with stop signs at all three approaches. The intersection will operate in a satisfactory manner with all three traffic control options. Which traffic control option is used depends on the movements the City would like to encourage.

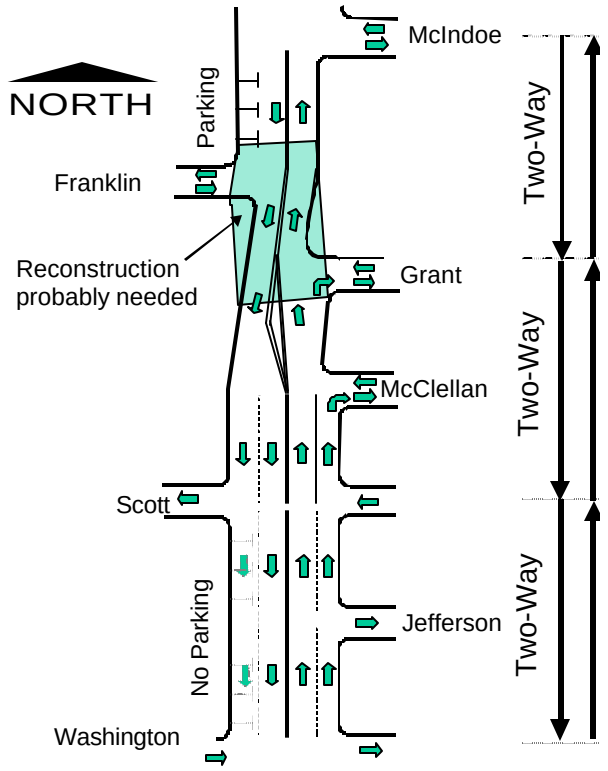


Figure 2.03-1 Alternative 2 – Two-Way Operation without Geometric Changes

C. <u>Alternative 3 – Two-way Operation with Geometric Changes</u>

Alternative 3 provides two-way traffic flow with four lanes of traffic between McIndoe Street and Washington Street. These four lanes would be created between Washington Street and McClellan Street by simply restriping the roadway and eliminating parking. North of McClellan Street, the roadway would be widened to accommodate the four lanes. The entire roadway from McClellan Street to McIndoe Street would require new curb and gutter and more pavement. With the roadway widening, catchbasins would need relocation and adjustment. All of the necessary widening can be constructed within the existing right-of-way in the terrace between the existing roadway and the existing sidewalk.

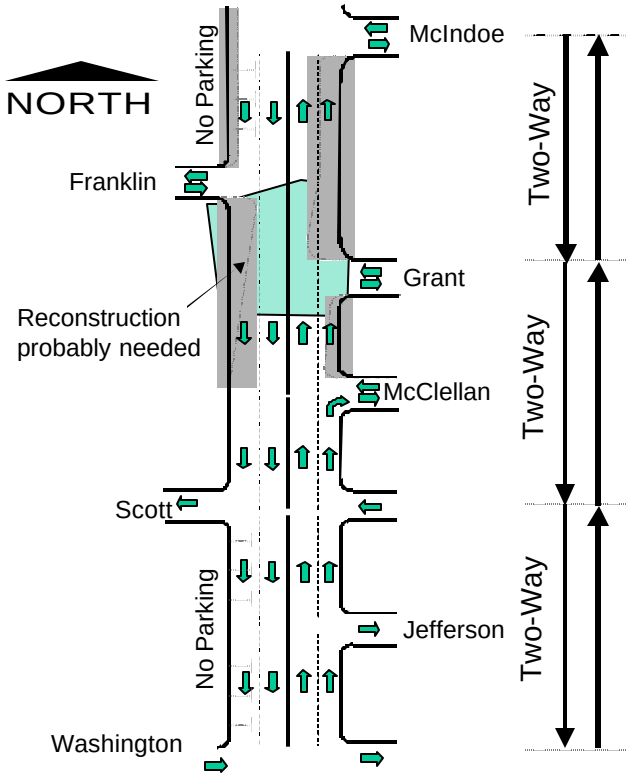


Figure 2.03-2 Alternative 3 – Two-Way Operation with Geometric Changes

As with Alternative 2, the 1st Street and McIndoe Street intersection would require a different traffic control configuration. Currently, traffic moving westbound to southbound is not required to stop. To keep this movement as a freeflow movement, north- and southbound traffic would need to be stop-controlled. One other possibility would be to stop westbound traffic on McIndoe Street and allow north- and southbound traffic to flow freely. One final option would be to fully stop all three intersection approaches. Which traffic control option is implemented depends on which movements the City would like to encourage.

D. Complimentary Suboption

One suboption that could be incorporated into either of the two-way alternatives (Alternatives 2 and 3) provides a right turn lane on 1st Street for northbound traffic destined for Jefferson Street. The right turn lane would be constructed on right-of-way obtained from the Federal Building property. No relocations would be necessary to construct the right turn lane. The turn lane would ease the right turn movement needed to distribute traffic to the CBD and provide a refuge for turning vehicles.

The right turn lane would address complaints voiced by some residents for the 2nd Street/ Jefferson Street intersection. Many feel the turning radii are too small for the 2nd Street/Jefferson Street and 2nd Street/Washington Street intersections. The small turning radii increases the perceived CBD congestion. They also feel it hinders easy access to many downtown establishments. With CBD distribution relocated to 1st Street, the same complaint could be voiced for the 1st Street/Jefferson Street intersection. This suboption addresses this concern.

2.04 ALTERNATIVE EVALUATION

A. General

Each alternative is briefly reviewed for traffic pattern changes, traffic operation, lane configuration, and potential costs (although no cost estimates are provided.) In describing traffic operation, the operation of two indicator intersections was modeled to determine the average delay and Level of Service (LOS).

The operation of a roadway (e.g., congestion levels) is typically described as "Level of Service." The LOS rating system describes the traffic flow conditions of a roadway or intersection and ranges from A (free flow conditions) to F (over capacity). The following paragraphs describe the characteristics of LOS for intersections.

LOS is determined by the average delay (in seconds) of all vehicles entering the intersection. The average delay is based on the peak 15-minute period of the peak hour being analyzed. Since this delay is an average value, some vehicles will experience substantially greater delay, and some will experience less delay than the average value. Intersections with short average delays have high Level of Service; conversely, intersections with long average delays have low Level of Service. LOS E is considered to be the limit of acceptable delay. An LOS of F for the total intersection is considered to be an indication of the need for improvement. Many communities establish a delay of up to 55 seconds for signalized intersections and 35 seconds for unsignalized intersections, both corresponding to LOS D, as their minimum standard. Therefore, the intersections overall must maintain an LOS D.

LOS characteristics are different for signalized and unsignalized intersections. Drivers anticipate longer delays at signalized intersections that carry large amounts of traffic. However, drivers generally feel unsignalized intersections should have less delay. Additionally, several driver behavior considerations combine to make delays at unsignalized intersections less desirable than at signalized intersections. For example, drivers at signalized intersections are able to relax during the red interval, whereas drivers on the minor approaches to unsignalized intersections must remain attentive in order to identify acceptable gaps for entry. Typically, LOS is only calculated for the legs of an unsignalized intersection that have to yield to other movements (stop control or left turns). Table 2.04-1 describes Level of Service characteristics for both signalized and unsignalized intersections.

B. Alternative 1 – Existing Conditions

With Alternative 1, traffic operations and patterns would remain similar to what currently exists. CBD-destined traffic entering from the west would continue to use 2nd Street for distribution and operation levels would be similar to what currently exists. Tables 2.04-2 and 2.04-3 show the overall intersection operation levels for the 1st Street/Jefferson Street and 1st Street/McIndoe Street intersections in the years 2001 and 2025. While the tables show better intersection operation for the one-way condition than for the two-way alternatives, this information can be

LEVEL OF SERVICES CHARACTERISTICS FROM 1997 HCM

LOS	Signalized Intersections	Unsignalized Intersections
A	Describes intersections with very low levels of delay that average less than 10 seconds per vehicle. This condition occurs with extremely favorable signal progression and most vehicles arrive on the green phase of the signal.	Describes intersections with very low levels of delay that average less than 10 seconds per vehicle.
B	Describes intersections with low levels of delay that are more than 10 seconds yet less than 20 seconds per vehicle. This condition generally occurs with short-cycle lengths and/or good signal progression.	Describes intersections with low levels of delay that are more than 10 seconds yet less than 15 seconds per vehicle.
C	Describes intersections with average delays ranging from 20 to 35 seconds per vehicle. Individual cycle failures (waiting through more than one cycle) may appear at this Level of Service. The number of vehicles stopping is also substantial at this Level of Service.	Describes intersections with average delays ranging from 15 to 25 seconds per vehicle.
D	Describes intersections with average delays ranging from 35 to 55 seconds per vehicle. The influence of congestion becomes more noticeable. This Level of Service may result from long-cycle lengths, unfavorable progression and/or high vehicle-to-capacity ratios. Many vehicles stop and the proportion of nonstopping vehicles declines. Individual cycle failures are noticeable.	Describes intersections with average delays ranging from 25 to 35 seconds per vehicle. The influence of congestion becomes more noticeable.
E	Describes intersections with average delays ranging from 55 to 80 seconds per vehicle. Individual cycle failures are frequent occurrences. This Level of Service is considered by most agencies to be the limit of acceptable delay.	Describes intersections with average delays ranging from 35 to 50 seconds per vehicle.
F	Describes intersections with average delays that are more than 80 seconds per vehicle. This Level of Service, considered to be unacceptable by most drivers, often occurs with over-saturation. The number of vehicles entering the intersection exceeds the intersection's capacity.	Describes intersections with average delays that are more than 50 seconds per vehicle. LOS F exists where there are insufficient gaps of suitable size to allow side-street traffic to cross safely though a major street traffic stream. This LOS is usually evident from extremely long total delays experienced by side-street traffic and queuing on the minor approaches.

Source: 1997 Highway Capacity Manual

misleading in that it is comparing two traffic routing options. Alternative 1 has better operation levels on 1st Street, yet the operation of the 2nd Street/Jefferson Street intersection is poor. Conversely, the operation of the 2nd Street/Jefferson Street intersection is better with Alternatives 2 and 3 than with Alternative 1.

With Alternative 1, designs that are currently being evaluated for the Washington Street/1st Street intersection would need to be reviewed/revised. All of the designs being considered assume the two-way operation of 1st Street. Redesign and concept revision would likely be necessary.

Since Alternative 1 keeps the existing lane configuration on 1st Street, no channelization or lane configuration problems are anticipated. Similarly, the existing on-street parking could remain. Alternative 1 has no right-of-way costs or infrastructure costs associated with it. Therefore, this Alternative is the least costly of the three alternatives.

C. Alternative 2 – Two-way Operation without Geometric Changes

With Alternative 2, traffic operation and patterns would change for the western portion of the study area. CBD-destined traffic originating from the west would be distributed through 1st Street rather than 2nd Street. Tables 2.04-1 and 2.04-2 show that intersection delay is greater for two-way operation than for one-way operation. This is somewhat misleading because this comparison is contrasting to different routing options that affect operation levels in other places of the CBD. While intersection delay is greater at these two 1st Street intersections, the operation levels are still well within tolerable ranges for a downtown urban area. Also, by relocating CBD-destined traffic to 1st Street, operation levels on 2nd Street will improve.

Alternative 2 is consistent with the intersection configurations currently being investigated for the 1st Street/Washington Street intersection. No concept review or revision would be necessary.

The lane configuration would need to be more closely reviewed with Alternative 2. Since a northbound lane needs to be dropped between Grant Street and McClellan Street, there is a possibility that the current crown and joint/crack patterns would be inconsistent with the proposed lane markings. In this instance, this one-block section may need resurfacing to ensure that proper lane marking and delineation are kept through the transition from four lanes to three lanes. Also with this alternative, all on-street parking south of Franklin Street would need to be removed to provide room for additional travel lanes.

Alternative 2 has no right-of-way costs associated with it. There would be costs associated with providing traffic control for two directions of traffic at several intersections. The existing striping would also need to be removed and new striping installed to accommodate both directions of traffic. There is also a chance that 1st Street from McClellan Street to Grant Street would need to be resurfaced to provide the appropriate lane marking/delineation.

D. Alternative 3 – Two-way Operation with Geometric Changes

Traffic patterns with Alternative 3 would be the same as with Alternative 2. CBD-destined traffic originating from the west would be distributed through 1st Street rather than 2nd Street. Tables 2.04-1 and 2.04-2 show that intersection delay is greater for two-way operation than for one-way operation. Operation levels for only Alternative 2 are shown on these tables. Since Alternative 3 has the same traffic pattern concept as Alternative 2, except with more lanes, operational levels would be slightly better. The discussion in Alternative 2 regarding the comparison of one-way operation to two-way operation, and its effect on adjacent streets, is also valid for Alternative 3.

1st Street/McIndoe Street Intersection	Existing One-Way Operation (Alternative 1)	Two-Way Operation (Alternative 2)
2000 Overall Operation	A 8.9	A 8.9
2025 Overall Operation	A 9.1	A 9.3

All numbers represent average delay in seconds

Figure 2.04-1 Operation Levels of the 1st Street/McIndoe Street Intersection

1st Street/Jefferson Street Intersection	Existing One-Way Operation (Alternative 1)	Two-Way Operation (Alternative 2)
2000 Overall Operation	A 9.5*	A 9.7
2025 Overall Operation	A 9.5	A 9.9

***** All numbers represent average delay in seconds

Figure 2.04-2 Operation Levels of the 1st Street/Jefferson Street Intersection

Alternative 3 is consistent with the intersection configurations currently being investigated for the 1st Street/Washington Street intersection. No concept review or revision would be necessary.

The lane markings and configuration for Alternative 3 are straightforward and no problems are anticipated. No on-street parking could remain with this alternative from McIndoe Street to Washington Street. The existing parking areas would be converted to travel lanes with this option.

Alternative 3 probably would have no right-of-way costs associated with it. There would be construction costs involved for expanding the cross section from McClellan Street to McIndoe

Street. The same traffic control modification costs associated with Alternative 2 would also apply with this alternative.

E. Complimentary Sub-option

Adding a right turn lane to northbound 1st Street at Jefferson Street in itself does not affect traffic patterns to the CBD. The lane would facilitate a movement that is likely to draw a fair amount of traffic. The right turn lane would improve 1st Street operations, yet the benefit would be somewhat negligible.

This suboption would, however, address criticisms that could be voiced regarding the two-way operation of 1st Street and would ease the perceived congestion levels associated with the CBD.

This suboption would require right-of-way from the Federal Building property. The suboption also requires constructing an additional lane with curb and gutter.

2.05 RECOMMENDATION

The study team recommends constructing Alternative 2. The study team also recommends the City consider providing the right turn lane contained in the complimenting suboption. Reasons supporting this recommendation include:

- This alternative reasonably distributes CBD-destined traffic and helps relieve the 2nd Street/Washington Street and 2nd Street/Jefferson Street intersections.

- Alternative 2 is consistent with the intersection designs being considered for the 1st Street/Washington Street intersection.

- Alternative 2 can be constructed with a minimum of infrastructure investment.

- Alternative 2 provides the capacity needed for projected traffic volumes.

- Alternative 2 enhances access to the proposed high technology employment area.

SECTION 3
2ND STREET

3.01 BACKGROUND

2nd Street runs north/south parallel to the Wisconsin River. It is a one-way street northbound as it currently distributes CBD-destined traffic originating from the west. Currently, 2nd Street carries about 3,300 vpd north of Jefferson Street and up to 7,000 vpd from Washington Street to Jefferson Street. 2nd Street is from 38 to 42 feet wide, face-of-curb to face-of-curb, except for the portion between McClellan Street and Grant Street, where it is 33 feet wide. From Washington Street to Jefferson Street, 2nd Street also forms the western boundary of a pedestrian mall just north of the Wausau Center Mall.

The City's CBD Master Plan recommends converting 2nd Street to two-way operation between Jefferson Street and Grant Street. The master plan states that two-way traffic operation will provide better access to CBD retail, business, residential, and institutional land uses. Figure 3.01-1 shows an existing picture of 2nd Street looking south from Grant Street.

Figure 3.01-1 2nd Street Looking South from Grant Street

3.02 ISSUES

The CBD Master Plan advocates the conversion of several CBD one-way streets into two-way streets to improve and enhance business access.

3.03 ALTERNATIVES

There are essentially two alternatives for 2nd Street. The first alternative allows the existing one-way northbound operation to continue. The second alternative redesignates 2nd Street to two-way traffic operation. With the second alternative, no geometric changes are made to the street. Improvements consist solely of restriping the existing roadway and changing signing and traffic control where necessary.

Currently two way traffic flow is not considered for 2nd Street from Jefferson Street to Washington Street or on Washington Street from 2nd Street to 1st Street. There are several reasons for this. First, the configurations being considered for the 1st Street/Washington Street/River Drive intersection do not support two-way operation on the East Washington Street approach. Second, allowing two-way traffic flow through the junction of Washington Street and

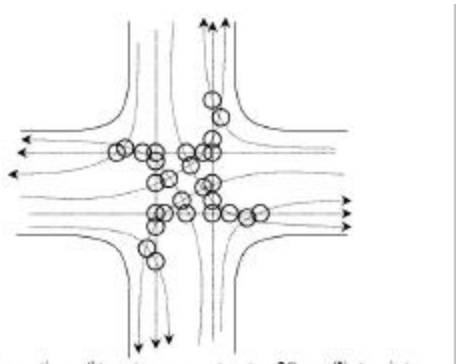
2nd Street intersection would be difficult with the small turning radii. Finally, west bound traffic queuing to enter the northwest mall entrance could extend past the 2nd Street/Washington Street intersection, making traffic flow around the intersection difficult. If access to the northwest mall entrance becomes a community priority, two-way traffic flow on 2nd Street from Jefferson Street to Washington Street could be further explored if coupled with intersection improvements.

With both alternatives traffic control for 2nd Street would change. 2nd Street would have stop signs that give priority to the east-west streets. Giving east-west streets free flow movement allows 1st Street to more effectively distribute traffic to the CBD.

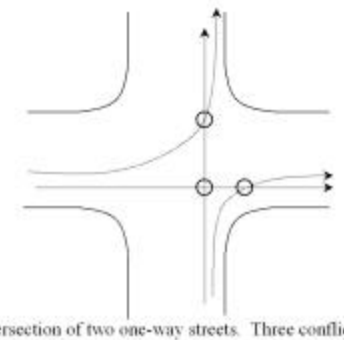
3.04 ALTERNATIVE EVALUATION

There are several factors in evaluating one-way versus two-way street operation that generally apply to 2nd Street, 3rd Street, McIndoe Street, and Jefferson Street. Therefore, the discussion under this section will also apply to Sections 4, 5, and 6.

City objectives influence the evaluation of one-way streets versus two-way streets in a central business district. One-way streets are generally beneficial when a downtown area is very congested, whereas two-way streets improve access. Three issues affect the decision to use one method of traffic flow over another: roadway operations, safety, and atmosphere.



Intersection of two two-way streets. 28 conflict points.



Intersection of two one-way streets. Three conflict points.

Figure 3.04-1 Conflict Points

A. Roadway Operations

As stated previously, one-way streets reduce congestion without the construction of new facilities. When compared to two-way streets, one-way streets advance traffic more efficiently, reduce stops and delays by about 50 percent†, and produce fewer conflicts, as seen in Figure 3.04-1. One downfall of one-way streets is that they increase trip lengths because drivers have to circle around to get to their destination. However, the trip time can be reduced by up to one third because congestion is reduced.

One-way streets also increase speeds, which can be a positive when discussing traffic progression, but can also produce more crashes. One-way streets can increase the capacity of a roadway and can provide more room for parking.

† *One-Way Streets Provide Superior Safety and Convenience* Stemley

One-way streets can be detrimental to emergency vehicle routes because the vehicles cannot use opposing lanes at intersections, especially during peak hours.

Transit can also be an issue with one-way streets. Riders may have to walk farther to get to and from transit stops and may be confused about where to board for return service. Travel distances can be increased by using crossover streets that connect pairs. However, with light passenger loads and moderate traffic, the travel time may be less with one-way streets compared to two-way streets.

Generally, CBD congestion in Wausau is not to a point that mandates one-way traffic flow on these minor streets. Therefore, while one-way streets provide more efficient traffic operation, this increase in effectiveness does not substantially improve traffic operations in downtown Wausau.

B. Safety

Research is inconclusive as to which alternative is the safest. Because there are fewer conflicts and stops on one-way streets, crashes are reduced. Some studies have found a crash reduction of 20 to 30 percent after converting two-way streets to one-way.* However, with increased speed, volume, and travel distance, crashes can increase, negating some of these gains. One study of a conversion from one-way to two-way found only a minor increase in crashes. Crash severity is less on one-way streets. This can be attributed to the fact that on two-way streets, head-on collisions are more common, whereas on one-way streets a majority of the accidents are rear-end collisions.

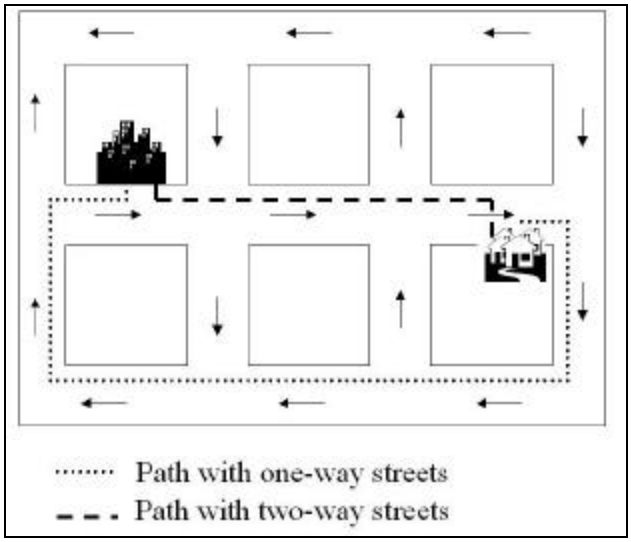


Figure 3.04-2 Indirect Routes of One-Way Streets

As far as pedestrian safety, there appears to be little difference in pedestrian accidents on one-way and two-way streets. One study did, however, conclude that there are fewer pedestrian accidents on one-way streets.

C. Atmosphere

Many cities prefer two-way streets in their central business district in order to maintain a small town atmosphere and to make it easy to access businesses, as demonstrated in Figure 3.04-2.

* *Safety of One-Way Urban Streets* Hocherman, Hakkert, and Bar-Ziv

Some planners and designers actually prefer somewhat congested two-way streets because they believe it gives the downtown area the look of a healthy business environment. There is no definitive link between one-way streets and impact on businesses. However, one-way streets can be confusing to motorists, especially visitors unfamiliar with the area, and may deter people from driving through the CBD.

D. Evaluation Specific to 2nd Street

1. Traffic Operations

Operationally, both the one-way and two-way alternatives move traffic satisfactorily. Tables 3.04-1 and 3.04-2 compare the operation levels for both alternatives at the 2nd Street/Jefferson Street and 2nd Street/Scott Street intersections. While in some instances the delays for the one-way traffic pattern are slightly less than for two-way operation, in all instances the operation is excellent.

Both the existing one-way circulation (Alternative 1) and the possible two-way circulation (Alternative 2) can be accomplished with the existing street section. Converting 2nd Street to two-way operation will require adding signal heads for the southbound direction at the 2nd Street/Scott Street intersection. Additionally, most other intersections will need to be restriped and resigned to accommodate both directions of traffic.

2nd Street/Jefferson Street Intersection (Unsignalized)	Existing One-Way Operation (Alternative 1)	Two-Way Operation (Alternative 2)
2000 Overall Operation	B	B
	10.3*	10.7*
2025 Overall Operation	B	B
	9.8*	11.2*

* All numbers represent average delay in seconds

Figure 3.04-3 Operation Levels of the 2nd Street/Jefferson Street Intersection

2nd Street/Jefferson Street Intersection (Signalized)	Existing One-Way Operation (Alternative 1)	Two-Way Operation (Alternative 2)
2000 Overall Operation	B	B
	13.6*	13.3*
2025 Overall Operation	B	B
	14.2*	14.2*

* All numbers represent average delay in seconds

Figure 3.04-4 Operation Levels of the 2nd Street/Scott Street Intersection

2. Parking

Currently 2nd Street has six parking spaces between Jefferson Street and Scott Street and about four 60-minute parking spaces between McClellan Street and Grant Street. All of this parking lies on the east side of the street. The current width of 2nd Street would allow these parking spaces to remain. However, it may be desirable to remove the ten spaces to foster two-way traffic flow.

3. Required Infrastructure Improvements

The current 2nd Street cross section is wide enough to accommodate two-way traffic flow. The 2nd Street/Scott Street signal installation would need to be modified to accommodate two-way traffic flow on 2nd Street.

3.05 RECOMMENDATION

The study team recommends converting 2nd Street to two-way traffic flow from Jefferson Street to Grant Street. Other than costs associated with adding signal heads and changing marking and signage, there appear to be no adverse effects associated with this traffic flow circulation shift. Changing the traffic flow also may provide more access to businesses and enhance the economic climate of the CBD.

SECTION 4
CONVERSION OF 3RD STREET

4.01 BACKGROUND

Figure 4.01-1 3rd Street Looking North from Scott Street

3rd Street is a north/south street that runs parallel to the Wisconsin River. Currently the section of 3rd Street from Washington Street to Jefferson Street is closed to motor vehicle traffic as it forms a pedestrian retail mall. North of Jefferson Street, 3rd Street continues its retail theme with ornamental lighting and streetscaping. It is a one-way street northbound from Jefferson Street to Grant Street with angle parking on either the east or west side of the street. North of Grant Street, 3rd Street converts to two-way operation with parallel parking on both sides of the street. Figure 4.01-1 shows a picture of 3rd Street looking north from Scott Street. Figure 4.01-2 schematically illustrates the configuration of 3rd Street from Jefferson Street to McIndoe Street.

3rd Street carries about 2,400 vpd in the vicinity of McIndoe Street. Traffic counts are unavailable for 3rd Street closer to Scott Street.

4.02 ISSUES

The CBD Master Plan indicates the businesses fronting the 3rd Street corridor do not have a convenient supply of parking spaces to meet peak retail periods, particularly in the winter. In the winter, the desirable walking distance between other parking areas and 3rd Street is shortened by the cold weather. Additionally, during the work week, many parking spaces near 3rd Street are occupied by area workers. Consequently, the Master Plan calls for increasing the number of parking stalls between Jefferson Street and Scott Street by placing angle parking on the east side of the roadway.

Additionally, the Master Plan states that two-way flow should be considered on 3rd Street to increase business accessibility. The reasons for this are the same as for the 2nd Street conversion, discussed in Section 3 of this report.

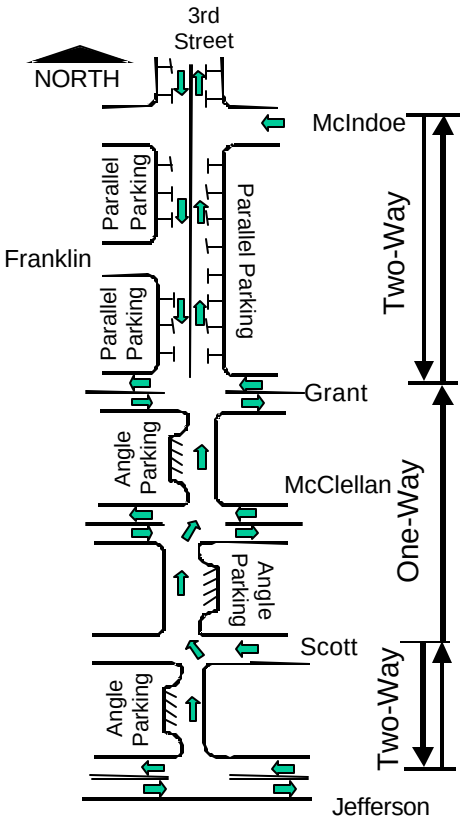


Figure 4.01-2 Schematic Layout of 3rd Street

The conflict between mobility and parking is inherent in this discussion. Increasing parking opportunities helps serve business needs and provides access. However, increased parking hinders through traffic flow for auto's as well as transit (buses).

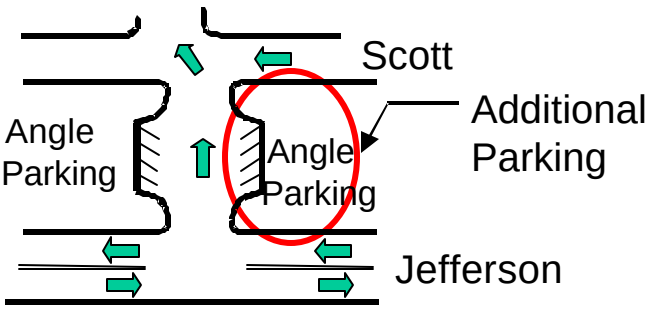


Figure 4.03-1 Alternative 1 - Additional 3rd Street Parking between Jefferson Street and Scott Street

4.03 ALTERNATIVES

A. Alternative 1 Additional Parking Between Jefferson Street and Scott Street

The first alternative for 3rd Street constructs additional northbound angle parking between Jefferson Street and Scott Street on 3rd Street's east side. The rest of 3rd Street would remain as it is now. 3rd Street would remain northbound between Jefferson Street and Grant Street and two-directional north of Grant Street. Figure 4.03-1 illustrates the additional northbound angle parking between Jefferson Street and Scott Street. This angle parking would add from 13 to 14 parking spaces in this block and would require about a tenth of an acre of new right-of-way from the adjacent park.

B. Alternative 2 Two-Way with Parallel Parking and Sidewalks

The second alternative reconstructs 3rd Street as two-directional from Jefferson Street to Grant Street. This alternative eliminates angle parking between Jefferson Street and Grant Street and provides parallel parking on both sides of 3rd Street. Figure 4.03-2 illustrates this configuration. It should be emphasized that this configuration requires the reconstruction of 3rd Street because the current alternating angle parking configuration does not allow the conversion.

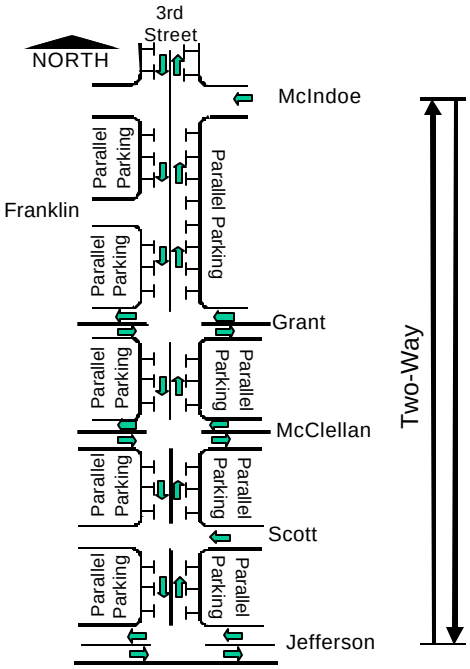


Figure 4.03-2 Alternative 2 – Two-Way Traffic Flow between Jefferson Street and Grant Street with Parallel Parking

C. Alternative 3 Two-directional Traffic between Jefferson Street and Scott Street with Additional Angle Parking

The third alternative is similar to the first option. This alternative keeps the existing lane configurations between Scott Street and McIndoe Street. In addition to more parking stalls, this option constructs a two-directional segment between Jefferson Street and Scott Street. Figure 4.03-3 illustrates this configuration.

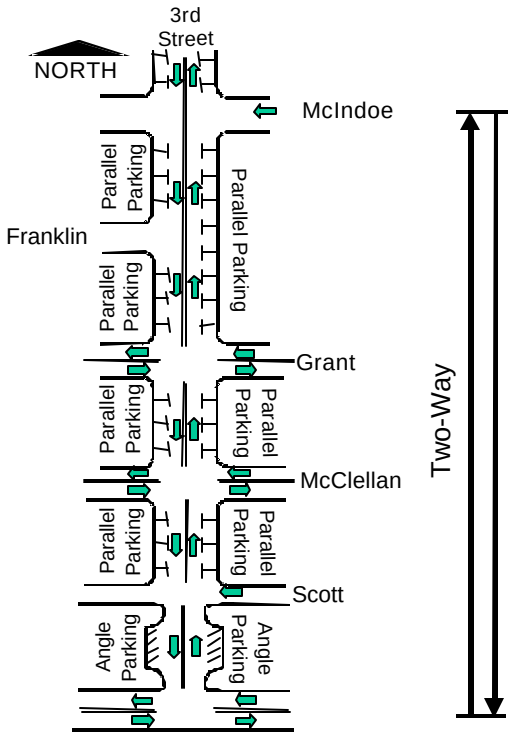


Figure 4.03-3 Alternative 3 – Two-Way Traffic Flow Between Jefferson Street and Grant Street with Angle Parking Between Jefferson Street and Scott Street.

4.04 ALTERNATIVE EVALUATION

A. Geometry

Currently there is a 60-foot right of way for much of 3rd Street. Within this right of way, there is only a certain amount of space to accommodate pedestrian movements, parking needs, and traffic flow. The current arrangement, with one-way traffic flow and angle parking, provides for a 12- to 14-foot walkway area on one side of the roadway and from 17 to 18 feet of space on the other side of the roadway. This space can be and is used for streetscaping and landscaping. Conversely, if two-way traffic flow is restored to 3rd Street with parallel parking on both sides, there will only be enough room to accommodate 10-foot walkways on both sides of the street. Most of the current streetscaping that exists on 3rd Street will be removed. This comparison is shown in Figure 4.04-1.

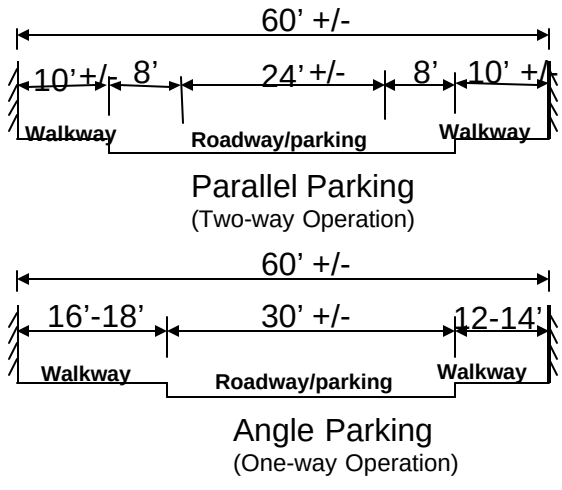


Figure 4.04-1 Angle Parking versus Parallel Parking

B. Parking

Most studies comparing angle parking versus parallel parking recommend the

use of parallel parking when possible. However, angle parking should be considered when there is a great demand for parking. Angle parking spots require less curb space than parallel parking spots, as seen in Figure 4.04-1.

Studies indicate that crash rates for parallel parking can range from 19 to 71 percent lower than angle parking with no change in crash severity.** With angle parking there is a greater chance of an exiting car backing up into oncoming traffic. There is also an increased possibility of bikers running into the left rear bumper of an angle-parked car. Angle parking generally also reduces the capacity of a roadway because it removes a lane that could otherwise be used for traffic.

However, there are benefits to angle parking. It increases the amount of parking in a CBD and/or create more space for pedestrian accommodations. Angle parking requires islands to delineate stalls. These islands decrease the crossings distance for pedestrians. Angle parking has also been found to be safer for pedestrians, especially people entering and exiting parked cars. Instead of entering and exiting the car in a live traffic lane (as with parallel parking) angle parking provides a protected area for the driver to enter and exit their vehicle. Many downtown areas favor angle parking because its historic look. People find angle parking easier to maneuver than parallel parking. The parallel parking maneuver requires more time than the angle parking maneuver, disrupting the flow of traffic (see Figure 4.04-2).

Table 4.04-2 compares the quantity of angle parking with the quantity of parallel parking that could be available if 3rd Street were converted to two-way operation.

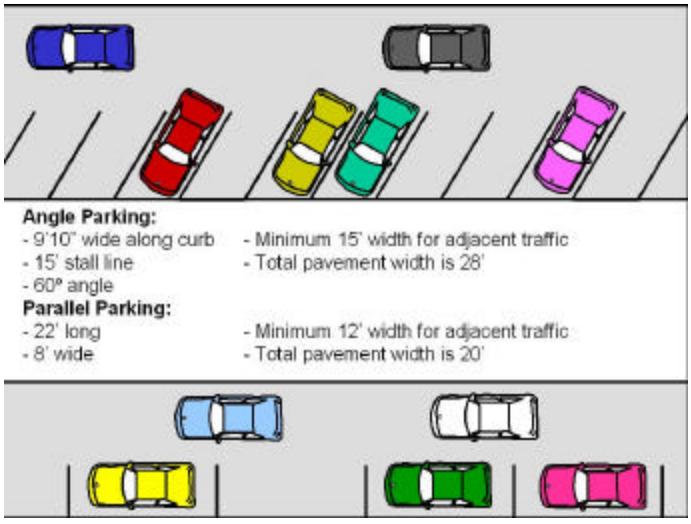


Figure 4.04-2 Benefits of Angle Parking Versus Parallel Parking

C. Traffic Operations

Because of the low traffic volumes, 3rd Street will operate satisfactorily with either one-way or two-way traffic flow. Tables 4.04-1 and 4.04-2 show the difference in LOS for the 3rd and Jefferson and 3rd and Scott Street intersections with and without two-way operation. In these instances, the conversion of 3rd Street to two-way traffic operation has little to no effect on traffic operations.

** *Safety Evaluation of Converting On-Street Parking from Parallel to Angle* McCoy, McCoy, Haden, and Singh

It should be noted however, that angle parking decreases though traffic mobility for vehicles and buses. As vehicles enter and exit parking stalls, through traffic is stopped.

D. Summary

The following matrix summarizes key components of the three alternatives.

Street Section	Alternative 1 One-Way Operation w/ Added Stalls	Alternative 2 Two-Way Operation w/ Parallel Parking	Alternative 3 Two-Way Operation w/Parallel Parking And Added Stalls
Jefferson to Scott	26	18	26
Scott to McClellan	13	18	18
McClellan to Grant	14	18	18

Table 4.04-1 Parking Space Comparison

3rd Street/Jefferson Street Intersection	Existing One-Way Operation	Two-Way Operation
2000 Overall Operation	B	B
	11.2*	13.6*
2025	B	B
	12.0*	12.4*

* All numbers represent average delay in seconds

Table 4.04-2 Operation Levels of the 3rd Street/Scott Street Intersection

Characteristic	Alternative 1	Alternative 2	Alternative 3
Addresses parking need	Adds 13 spaces	Adds 14 spaces	Adds 22 spaces
Enhances business accessibility	No	Yes	Yes
Conversion costs	Marginal	Large	Large
Pedestrian Accom/ Streetscaping.	Maintains	Diminishes	Diminishes
Traffic operations	Satisfactory	Satisfactory	Satisfactory

Table 4.04-3 Evaluation Summary

One other consideration should be noted. Allowing two-way traffic operation on 3rd Street from Jefferson Street to Scott Street could encourage "cruising: or recreational driving around the 400 block in the Central Business District.

4.05 RECOMMENDATIONS

The study team recommends keeping the current one-way traffic flow if the City desires more parking, a section of angle parking for northbound traffic on the east side of 3rd Street between Jefferson Street and Scott Street could be added. This recommendation is referred to as Alternative 1 in Section 4.01. Reasons supporting this recommendation include:

- Alternative 1 provides additional parking in an area that has a parking need.
- Alternative 1 provides room for existing and future pedestrian needs and streetscaping efforts.
- Alternative 1 has the lowest construction costs.

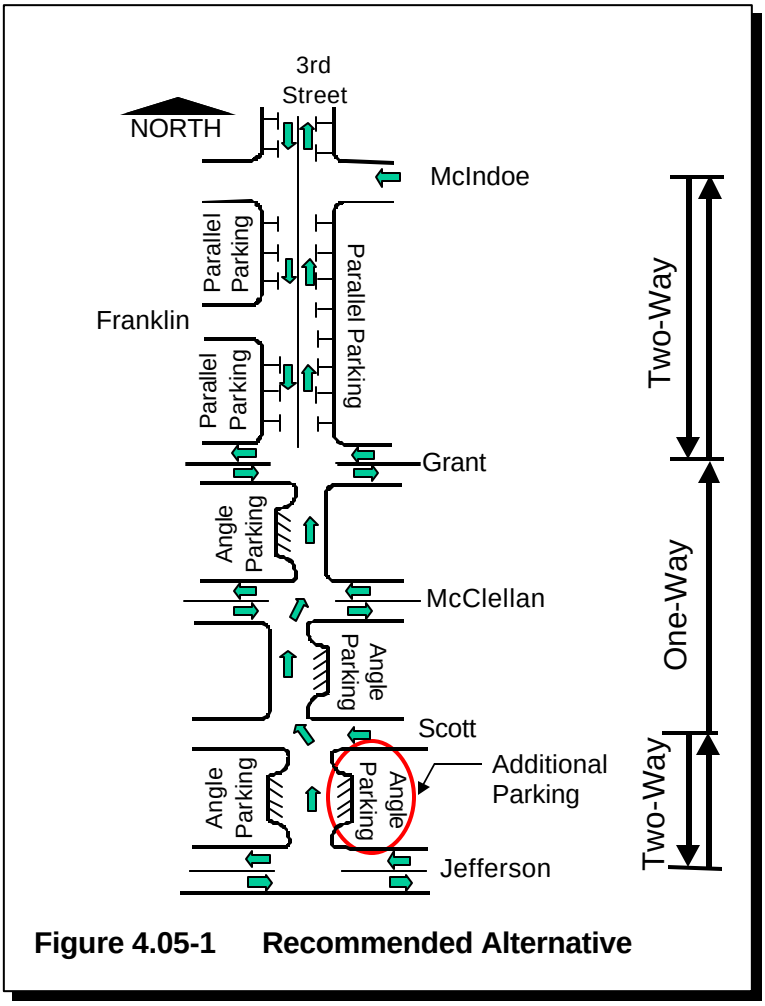


Figure 4.05-1 Recommended Alternative

Alternatives 2 and 3 have much higher conversion costs and limit the space for pedestrian movements and streetscaping. The increased traffic accessibility associated with these alternatives and extra parking spaces do not appear to outweigh the extra construction costs, decreased pedestrian facilities, and decreased streetscaping opportunities.

Two considerations accompany this recommendation. Adding angle parking on the east side of 3rd Street from Jefferson Street to Scott Street will require a tenth of an acre of open space. Additionally, parking maneuvers associated angle parking will continue to hinder through traffic flow on 3rd Street.

SECTION 5
MCINDOE STREET

5.01 BACKGROUND

McIndoe Street runs east/west perpendicular to the Wisconsin River. It is a one-way street westbound as it currently helps to distribute CBD-destined traffic originating from the north. Currently, McIndoe carries from 1,600 to 3,500 vehicles per day. The City's CBD Master Plan recommends converting McIndoe Street to two-way operation to provide better access to CBD retail, business, residential, and institutional land uses. Figure 5.01-1 shows an existing picture of McIndoe Street looking west from 5th Street.

Figure 5.01-1 McIndoe Street Looking West from 5th Street

McIndoe Street was recently reconstructed and has a 36-foot face-of-curb to face-of-curb cross section west of 5th Street. The crown lies 14 feet north of the south curb line between 5th Street and 3rd Street. At 3rd Street, the crown angles northerly and then lies 10 feet south of the north curb line. East of 5th Street, McIndoe Street has a 32-foot face-of-curb to face-of-curb section. Parallel parking is allowed on the north side of the street east of 5th Street, but it is not allowed west of 5th street.

5.02 ISSUES

The CBD Master Plan advocates considering the conversion of several CBD one-way streets into two-way streets to improve and enhance business access.

5.03 ALTERNATIVES

There are essentially two alternatives for McIndoe Street. The first alternative allows the existing one-way westbound operation to continue. The second alternative redesignates McIndoe Street to two-way traffic operation. With the second alternative, no geometric changes are made to the street. Improvements consist solely of restriping the existing roadway and changing signing and traffic control where necessary.

5.04 ALTERNATIVE EVALUATION

A. Operations

There are several general factors in evaluating one-way versus two-way street operation that generally apply to 2nd Street, 3rd Street, McIndoe Street, and Jefferson Street. Therefore, the factors discussed in Section 3 also apply to this section. In summary, one-way streets generally have better traffic operation with larger traffic volumes. Speeds and progression also can be enhanced with one-way traffic flow.

Many communities, however, are favoring two-way traffic flow on CBD streets whenever possible. There is a perception that two-way traffic flow preserves a small town atmosphere and makes it easier to access businesses. Some planners also prefer two-way streets with slightly more traffic because they believe it gives the downtown area the look of a healthy business environment.

Generally, CBD congestion in Wausau is not to a point that mandates one-way traffic flow on minor streets such as McIndoe Street. Therefore, while one-way streets provide more efficient traffic operation, this increase in effectiveness does not substantially improve traffic operations in downtown Wausau. Tables 5.04-1 and 5.04-2 illustrate the traffic operation of McIndoe Street with 5th Street and 6th Street for both one-way and two-way traffic operation.

McIndoe Street/5th Street Intersection	Existing One-Way Operation	Two-Way Operation
2000 Overall Operation	B	B
	17.4*	14.6*
2025	B	B
	12.6*	16.2*

* All numbers represent average delay in seconds

Table 5.04-1 Operation Levels of the McIndoe Street/5th Street Intersection

McIndoe Street/6th Street Intersection	Existing One-Way Operation	Two-Way Operation
2000 Overall Operation	A	A
	8.9	9.4
	(23.9 McIndoe delay)	(26.4 McIndoe delay)
2025	A	A
	8.8	11.1
	(19.8 McIndoe delay)	(up to 51.8 McIndoe delay)

* All numbers represent average delay in seconds

Table 5.04-2 Operation Levels of the McIndoe Street/6th Street Intersection

The tables show nominal difference in the operation levels between one-way and two-way operation. In some instances, the modeling shows two-way operation providing better operation levels than one-way operation. While this probably will not happen, the modeling does indicate that a serious deterioration in operation levels will not occur with the conversion of McIndoe Street to two-way operation. One aspect to note is the delay associated with McIndoe Street on the 6th Street intersection, whether it has one-way or two-way traffic flow. Because this intersection is two-way stop-controlled, the delays on McIndoe Street will grow greater as traffic increases on 6th Street. Eventually, these side-street delays may become irritating to roadway users trying to cross or turn onto 6th Street.

One other factor involves train disruption. When trains stop traffic on flow on 6th Street, queues can develop that block McIndoe Street. Currently, only the east approach is affected. With two-way traffic flow on McIndoe both the east and west approaches would be affected.

B. Parking

Currently, on-street parking is not allowed on McIndoe Street from 5th Street west, yet is allowed east of 5th Street. While the current roadway cross section west of 5th Street could accommodate parking on one side, we recommend continuing the prohibition of parking to maintain street mobility. Additionally, parallel parking on McIndoe Street east of 5th Street should be removed if the street is converted to two-way traffic flow. This would result in a loss of approximately 15 to 20 parking spaces.

C. Infrastructure Improvements

Converting McIndoe Street to two-way operation would require modifying the current signals at the McIndoe Street and 5th Street intersection. It would also require resigning and restriping the entire five blocks of roadway.

Because most of McIndoe Street has been recently reconstructed, no geometric changes should be needed to accommodate two-way traffic flow. However, the location of the crown on McIndoe Street from 3rd Street west may cause some lane designation problems. It is likely that one lane of traffic will have to straddle the roadway crown for these two blocks of roadway.

5.05 RECOMMENDATION

If the City desires increasing accessibility the study team recommends converting McIndoe Street from one-way operation to two-way operation. The reasons supporting this recommendation include:

- The conversion would increase business accessibility, a stated goal in the CBD Master Plan.

- The conversion to two-way traffic flow could be accomplished with a marginal amount of infrastructure costs (signage and adding signal heads).

- The conversion to two-way traffic flow does not cause traffic operations to deteriorate in a noticeable way.

Consequences of the recommendation include:

- Delays for vehicles waiting on the west approach or McIndoe at 6th Street could grow long in future years.

- Traffic on McIndoe may have to straddle the roadway crown for some portions.

- 6th Street queues from train disruption could block the McIndoe west approach.

SECTION 6
JEFFERSON STREET

6.01 BACKGROUND

McIndoe Street runs east/west perpendicular to the Wisconsin River as a two-way street. Jefferson Street currently helps to distribute CBD-destined traffic originating from the west. Currently, Jefferson Street carries from 3,100 to 3,500 vpd. Much of this traffic originates from Washington Street and northbound 2nd Street with traffic that wants to travel easterly. Two-thirds of the traffic on Jefferson Street during the evening peak hour travels east.

Figure 6.01-1 Jefferson Street/3rd Street Intersection Looking East on Jefferson Street

6.02 ISSUES

The City's CBD Master Plan does not recommend converting Jefferson Street to one-way operation. Instead, some in the CBD have advocated the consideration of one-way traffic flow because it would provide room for the installation of angle parking. This area, particularly around 3rd Street, has a parking space need that additional parking could help offset.

Typically, converting a two-way street to a one-way street is done to increase the capacity of the street and aid traffic progression. A one-way Jefferson Street would tend to cause Jefferson Street to compliment Scott Street, which is one-way westbound. In a sense, one-way conversion would complete a one-way pair using Jefferson Street and Scott Street (instead of Forest Street and Scott Street).

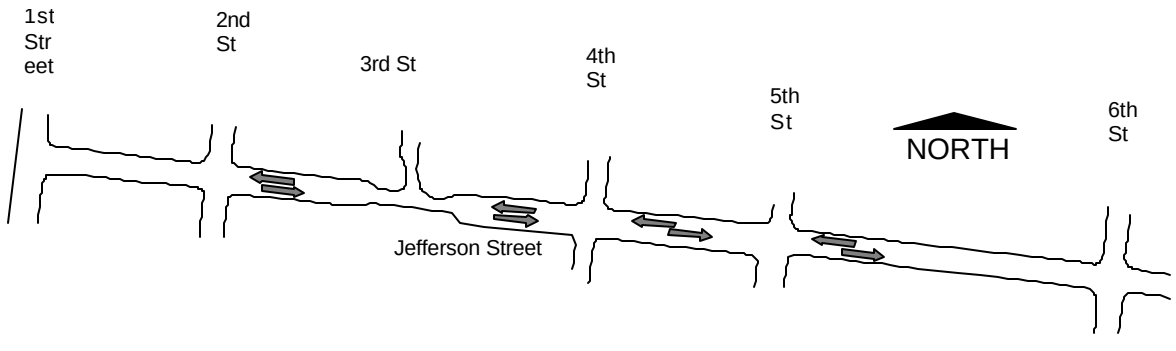


Figure 6.03-1 Existing Jefferson Street Configuration

Yet this reasoning is contrary to the desires of those advocating angle parking. Angle parking instead impedes traffic flow and would tend to discourage traffic from using Jefferson Street. In this case, Jefferson Street would become a parking destination.

6.03 ALTERNATIVES

There are essentially two alternatives for Jefferson Street. The first alternative maintains the existing two-way operation to continue as illustrated in Figure 6.03-1 on the previous page.

The second alternative would redesignate Jefferson Street to one-way traffic operation eastbound and add angle parking. With the second alternative, there would need to be some geometric changes to the roadway to provide additional angle parking. These changes would likely include the removal of some of the pedestrian island on Jefferson in the vicinity of 3rd Street to widen the current pavement cross section. Additional islands would also need to be constructed to guide the angle parking and prevent right eastbound turns onto Jefferson. The provision of angle parking would likely conflict with some of the existing driveways in the 200 block of Jefferson. Figure 6.03-2 illustrates some of the geometric changes that may be necessary with this redesignation between 2nd Street and 4th Street.

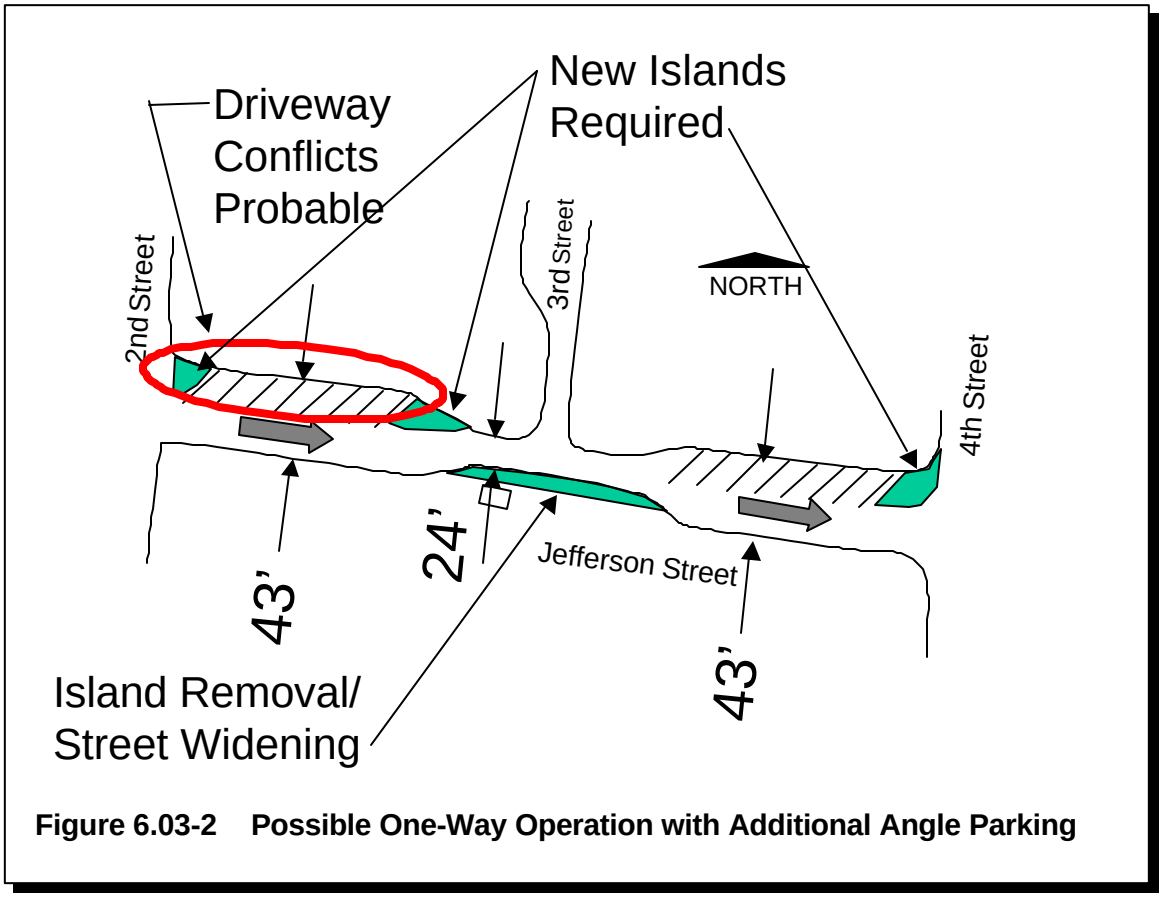


Figure 6.03-2 Possible One-Way Operation with Additional Angle Parking

6.04 ALTERNATIVE EVALUATION

A. Operations

There are several general factors in evaluating one-way versus two-way street operation that generally apply to 2nd Street, 3rd Street, McIndoe Street, and Jefferson Street. The factors discussed in Section 3 therefore also apply to this section. In summary, one-way streets generally have better traffic operation with larger traffic volumes. Speeds and progression also can be enhanced with one-way traffic flow. In this case, however, traffic flow would probably be impeded because of the angle parking. Angle parking generally slows through traffic. As stated in previous sections, many communities favor two-way traffic flow on CBD streets to preserve a small town atmosphere and to make it easy to access businesses.

Congestion and traffic volumes inside Wausau's CBD are not to a point that one-way traffic flow is mandated. In this case, the operations modeling shows little difference between one-way and two-way traffic flow. Table 6.04-1 shows the Level of Service and Delay in seconds at the Jefferson Street/2nd Street intersection.

Jefferson Street/2nd Street Intersection	Existing One-Way Operation	Two-Way Operation
2000 Overall Operation	A 8.7*	A 7.9*
2025 Overall Operation	A 9.8*	A 8.8*

* All numbers represent average delay in seconds

Table 6.04-1 Operation Levels of the Jefferson Street/2nd Street Intersection

The table shows nominal difference in the operation levels between one-way and two-way operation at this intersection. This table does not reflect the travel service deterioration caused by delays associated with angle parking. Angle parking would impede eastbound traffic flow in either the two-way or one-way scenarios.

One other affect of making Jefferson Street one-way is the rerouting of transit routes to Scott Street. Currently, several bus routes serve the mall area using west bound Jefferson Street. These routes would need to be moved to Scott Street, which is an additional block north of the mall.

B. Parking

Currently from 3rd Street to 4th Street there is space available for about 12 spaces total for both sides of the street. Eliminating parallel parking and converting one side to angle parking would provide about 10 spaces, for a net decrease in parking spaces. (Note: If angle parking were provided on both sides of the street, there could be the opportunity to provide up to 20 spaces.)

Because of driveways, there are only nine parking spaces on Jefferson Street between 2nd and 3rd Street. Angle parking would be more difficult to implement in this area since there is less unbroken useable space. Traffic using the driveways could present a hazard to parking vehicles. For this reason, we do not recommend installing angle parking on the north side of Jefferson Street from 2nd Street to 3rd Street.

6.05 RECOMMENDATION

The study team does not recommend providing angle parking on Jefferson Street, which currently serves an important function of distributing vehicles in the CBD. It also functions as a secondary compliment to Scott Street. Angle parking would hinder this function, impede traffic flow, and probably increase crashes. The City should preserve mobility on Jefferson Street so that people can get to and travel through the CBD.

The study team has no recommendation regarding the conversion of Jefferson Street to one-way traffic flow. This conversion would function adequately and preserve mobility on Jefferson Street. The conversion of Jefferson Street to one-way flow, however, runs contrary to a CBD objective of providing as much business access as possible. Converting other CBD streets to two-way traffic flow while converting Jefferson Street to one-way flow appears to serve conflicting objectives.

SECTION 7
THOMAS STREET INTERSECTIONS

7.01 BACKGROUND

The CBD Master Plan calls for the development of tourist-oriented land uses such as a hotel and/or Civic Center on River Drive. If implemented, this development would generate traffic that would distribute itself through the Washington Street/River Drive intersection, the River Drive/Thomas Street intersection, and the Thomas Street/Grand Avenue intersection. Impacts to the River Drive/Washington Street intersection were discussed in a previous report dealing solely with solutions to this intersection. This section reviews the impacts of this development to the unsignalized River/Thomas intersection and the signalized Thomas Street/ Grand Avenue intersection. Figure 7.01-1 illustrates the area of potential tourist-oriented development and the intersections of concern.

Figure 7.01-1 Thomas Intersections

7.02 ISSUES

A. Thomas Street/River Drive Intersection

The Thomas Street/River Drive intersection is currently unsignalized. Traffic on River Drive is somewhat moderate; however, Thomas Street carries about 20,000 vehicles per day on a two-lane roadway. This provides few gaps in the eastbound traffic stream. Therefore, turning left from River Drive onto Thomas Street is very difficult. Currently only about 25 vehicles make this left-turning movement during the evening rush hour, so left-turning delays are moderate. There is

Figure 7.02-1 Left Turn Delays on the River Drive Approach

concern; however, that traffic generated by the proposed tourist-oriented development could substantially increase delay for left-turning vehicles at this intersection. Currently delays for vehicles turning left from River Drive during the evening average about 37 seconds, corresponding to LOS D.

In addition, the configuration and geometry at this intersection makes it difficult to signalize. Signalization is probably the only solution that could effectively reduce River Drive delays. First, there is a narrow 29-foot wide bridge about 200 feet west of the intersection.

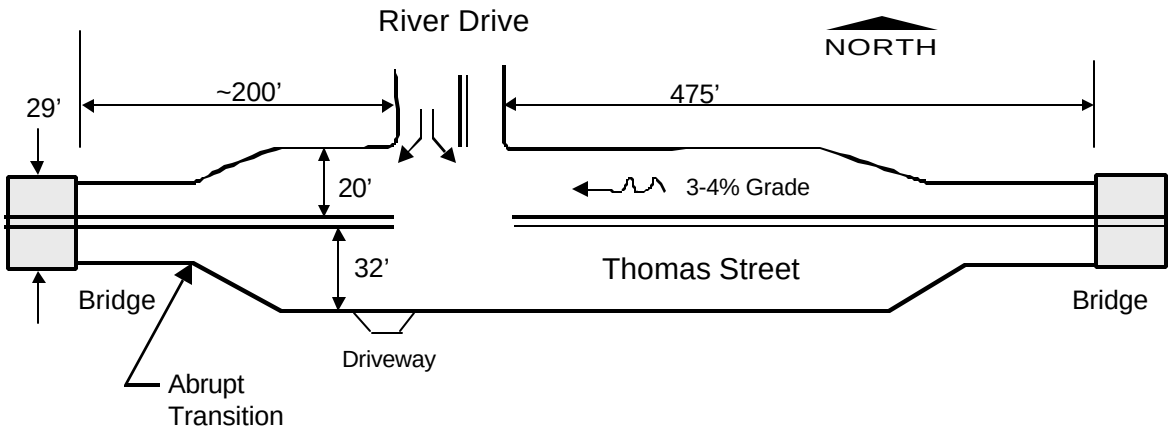


Figure 7.02-2 Thomas Street/River Drive Intersection

Developing a left turn lane or median refuge for left-turning eastbound traffic is quite difficult since through traffic would have an abrupt angle to travel around the left turn lane. Softening this abrupt transition is not possible because of the bridge width and location.

Additionally, Thomas Street has a 3 to 4 percent grade at the River Drive intersection. Placing a traffic signal at the intersection would cause queuing on the west approach. This queuing would likely extend well onto the bridge. There is a concern that during the winter months, eastbound vehicles stopped on the bridge may have difficulty gaining traction when the bridge has icy conditions. Roadway grades could also be a concern on River Drive if queuing became extensive. The steep grades on River Drive also make queuing a concern.

B. Thomas Street/Grand Avenue Intersection

The Thomas Street/Grand Avenue Intersection currently experiences some congestion during peak periods of the day. The north and the east approaches operate at LOS D with about 40 to 45 seconds of average delay during the evening rush hour. With additional development and background growth, this intersection is projected to operate at LOS F with extreme delays on the north and west approaches of 115 to over 200 seconds of average delay. One of the key movements affecting intersection operation is the northbound to westbound left turn. Expanding the intersection, however, is difficult in this urban setting.

Figure 7.02-3 shows a picture of the intersection looking northeast. Figure 7.02-4 schematically illustrates the intersection configuration.

Figure 7.02-3 Thomas Street and Grand Avenue Intersection

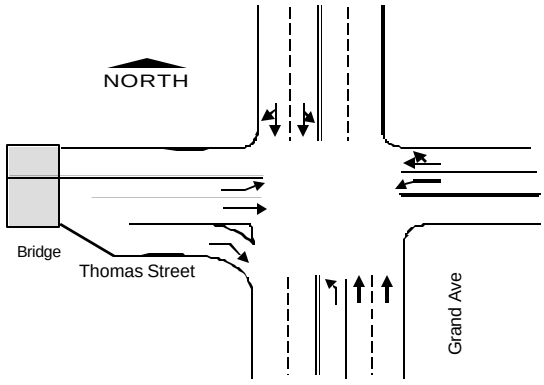


Figure 7.02-4 Thomas Street/Grand Avenue Configuration

7.03 ALTERNATIVES

A. Thomas Street/River Drive Intersection

Ultimately it would be beneficial to reconstruct and expand the existing bridges over the Wisconsin River and railroad. This would allow the expansion of Thomas Street to four lanes. Current traffic volumes on Thomas Street would support such an expansion. The Wisconsin DOT and City, however, must balance infrastructure needs with available funding and competing priorities. Therefore, improvements sometimes are postponed to fit the overall program. In this instance, the Wisconsin River bridge is a very long and costly bridge to replace. Therefore, plans for the immediate area should probably assume that intersection configuration changes must occur within the current geometry.

Given the current geometry, there are essentially two intersection options. The first alternative would let the intersection remain in its unsignalized condition. At some point with this option, another connection to River Drive could be explored.

The second option would signalize the intersection and provide a left turn bay for eastbound to northbound left-turning traffic. As mentioned, this alternative would have to develop the left turn bay by striping the existing pavement and/or perhaps introducing a channelizing island. Signals would also be installed.

B. Thomas Street/Grand Avenue Intersection

At the Thomas Street/Grand Avenue intersection, there are heavy northbound/southbound movements. There are also large turning-movement volumes for the eastbound-to-southbound and northbound-to-westbound movements. These movements are the critical

movements affecting signal timing and intersection operation. Currently, there are two through lanes to serve northbound and southbound traffic (four lanes total). At this point, adding capacity for the through movements is not feasible. Providing three lanes in each direction (six lanes total) on Grand Avenue would cause impacts beyond the scope of this analysis. The eastbound to southbound movement already has a channelized right turn lane. Therefore, the right -turn movement only minimally affects intersection operation.

Alternatives must therefore deal with the remaining controlling movement, the northbound to westbound left turn. Currently, about 475 vehicles make this movement during the evening peak hour. This volume of left turning vehicles could justify a dual left turn lane instead of the single left turn lane that currently exists. This would require expanding Thomas Street to four lanes near this intersection. Adding a dual left turn lane at this intersection would also require changing the signal phasing at the intersection. Currently there is a dedicated left turn phase, with left turns permitted during the through phase. These permissive left turns would be prohibited with a dual left turn lane.

7.04 ALTERNATIVE EVALUATION

A. Thomas Street/River Drive Intersection

1. Option 1 – Intersection Remains Unsignalized

With this option, the delay for left turning vehicles on River Drive would grow. Eventually, the delay for this movement would be so great that eastbound River Drive vehicles would be diverted to the River Drive/Washington Street intersection. This diversion is not necessarily a bad consequence. Traffic is diverted to an intersection able to better handle the increased volume. The redirection, however, will result in increased trip lengths because of the indirection of these vehicles. When delays grow to this level, the City may want to explore providing an alternate access to River Drive between Thomas Street and Washington Street.

2. Option 2 – Signalize Intersection

With Option 2, the delay for left-turning vehicles is greatly reduced. The total delay for the intersection is slightly greater because the Thomas Street through movement has a signal introduced into its flow. Also, because of the two-lane configuration of Thomas Street and the large traffic volumes, longer queues will develop on Thomas Street when the signal services River Drive. Installing a signal at this intersection poses previously discussed concerns. Specifically, the transition angle for eastbound through traffic may have a deflection that is more than desirable. Additionally, queuing on the west approach will likely extend onto the bridge that may cause problems during icy conditions.

Table 7.04-1 compares some of the main characteristics of the two options.

Characteristic	Option 1 – No Signal	Option 2 – Signal
River Drive left-turn operation 2000	D 37 seconds of delay	B 18.3 seconds of delay
River Drive left-turn operation 2025	F 114 seconds of delay	C 24 seconds of delay
Issues	▪ Diversion back to River Drive/Washington Street Intersection ▪ Delay causes frustration and unwise gap acceptance	▪ Developing left turn lane for eastbound to northbound traffic – difficult deflection ▪ Queuing on bridge during icy conditions

Table 7.04-1 Option Comparison Thomas Street/River Drive Intersection

B. Thomas Street/Grand Avenue Intersection

If the intersection is left in its current condition, delays will grow substantially for the north and west approaches. Traffic modeling indicates that with current traffic projections, delay will become intolerable. It is likely that delays this great will not be realized because travelers will seek alternate routes.

However, providing an additional left turn lane for northbound traffic does mitigate some of this congestion and reduces delay by about a third. Table 7.04-2 compares the operation of this intersection with and without the dual left turn lane.

Thomas/Grand Intersection	Existing Configuration	Dual Left Turn Lane
2000 Overall Operation	B 38.2	B 13.5 s
2025 Overall Operation	F 278 s	F 183 s

All numbers represent average delay in seconds

Table 7.04-2 Operation Levels of the Thomas Street/Grand Avenue Intersection

7.05 RECOMMENDATIONS

Because the need for these intersections is not immediate, but rather long term, the study team recommends a course of action rather than a specific alternative. Therefore, the City should:

- *Leave the River Drive/Thomas Street intersection as is and monitor its operation*. Currently only a few vehicles turn left from the north approach and delays are not to a point where they are intolerable. As River Drive develops, development-generated traffic may chose to

use alternate routes that avoid this intersection. If this occurred, projected left turn delays may never come to fruition.

- *Advocate expanded four-lane bridge when the bridge condition require reconstruction.* Eventually Thomas Street will probably warrant a four-lane roadway section. Expanded bridges for the river and the railramp would allow this to occur and would provide appropriate transitions for left turn lane development at the intersection.

- *In the future, consider providing an additional connection between Washington Street and Thomas Street.* An additional connection would provide an alternative to the River Drive/Thomas Street intersection.

- *If left turn delays for River Drive become excessive, consider signalizing the intersection.* When this occurs, a signal warrant analysis will need to be performed. The previously mentioned concerns should also be given consideration before the signal is installed.

For the Thomas Street/Grand Avenue Intersection:

- *Begin planning to add an additional left turn lane for the northbound-to-westbound movement.* At some point in time this intersection will need relief and provision of this turn lane is really the only low impact option available aside from expanding Grand Avenue. Adding this turn lane will probably require right-of-way acquisition in the northwest and southwest intersection quadrants. Adding this left turn lane will also require expanding the railroad viaduct bridge to four lanes.

- *Plan to reconstruct the intersection when the railroad viaduct bridge is reconstructed.*

SECTION 8
WASHINGTON STREET/2ND STREET INTERSECTION

8.01 BACKGROUND

Currently the majority of traffic entering the CBD from the west travels through the Washington Street/2nd Street intersection. From this intersection, the traffic is distributed throughout the CBD using 2nd Street. Unfortunately, traffic must make a 90 degree turn at this intersection in a rather constrained area. This has led some citizens to request that the radii of the intersection be reduced. These citizens state it would ease traffic flow and make it less awkward to enter the CBD. This request is also advocated in the CBD Master Plan under its infrastructure recommendations. Figure 8.01-1 illustrates traffic flow through the CBD and the intersection of concern.

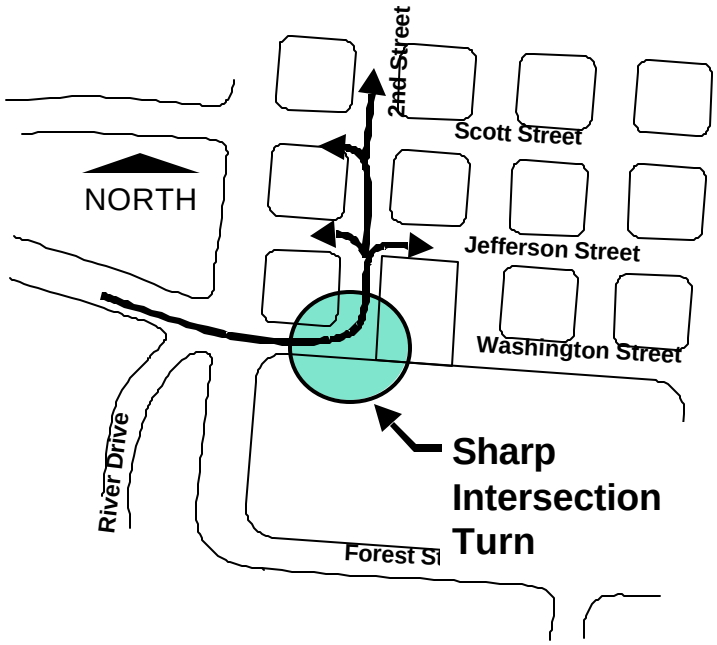


Figure 8.01-1 Washington Street/2nd Street Intersection

8.02 ISSUES

There are several issues surrounding this improvement, some dealing with traffic distribution throughout the CBD, and some dealing with physical constraints.

A. Two-way Traffic Flow on 1st Street

Currently, alternatives for the Washington Street/River Drive/1st Street intersection are being investigated to improve traffic circulation through the area. This evaluation is available in a separate, previously released report complimenting this study. All of the intersection alternatives investigated have the conversion of 1st Street to two-way traffic flow inherent in their designs. Two-way traffic flow on 1st Street creates another option for CBD traffic distribution from the west. Traffic may then use 1st Street instead of 2nd Street to get to their CBD destination. Two of the three intersection alternatives favor the use of 1st Street for CBD distribution. If 1st Street becomes a major route used for CBD distribution, easing the turning radii of the Washington/2nd Street intersection becomes a less significant issue. Instead of slowing the majority of CBD traffic originating from the west, the small turning radii only affects a small portion of the CBD traffic.

B. Pedestrian Movements

The tight turning radius at the Washington Street/2nd Street intersection helps to slow traffic and acts as a calming measure. Slower traffic generally enhances pedestrian travel and street crossings. Slower traffic also has safety benefits because it gives pedestrians more time to react and avoid conflicts. When vehicle-pedestrian collisions do occur, they tend to be less severe.

The calming this corner provides therefore has beneficial effects to pedestrian movements. This is particularly true in light of pedestrian traffic generated from the pedestrian mall located just east of this intersection.

Also, with the reconstruction of the 1st Street/Washington Street intersection, traffic control for 2nd Street would change. 2nd Street would have stop signs that give priority to the east west streets, such as Jefferson Street. Having east west street free flow movement will allow 1st Street to more effectively distribute traffic to the CBD.

C. Physical Constraints

The Washington Street/2nd Street intersection curb radii is about 15 feet. While this is a common curb radius in urban areas, for an arterial, this radii would generally be considered too small.

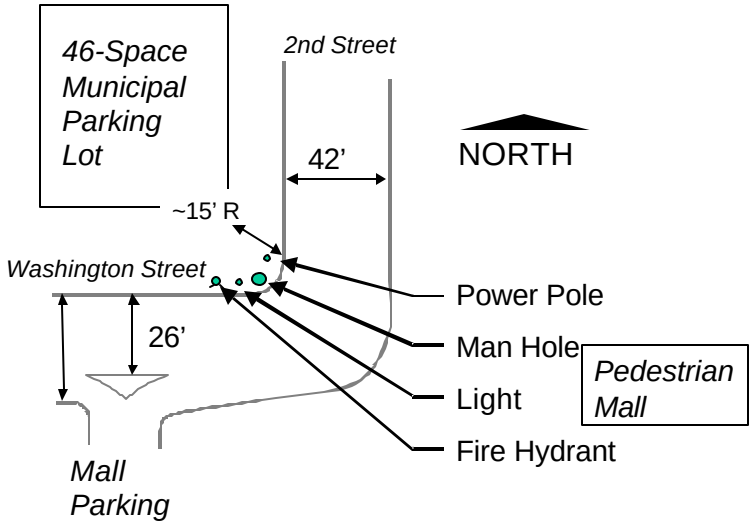


Figure 8.02-1 Washington Street/2nd Street Intersection

There are also numerous utilities right at the corner of Washington Street and 2nd Street. These utilities include an aboveground power pole, a manhole, a street light, and a fire hydrant. All of these utilities would need relocation if the curb radius was made any larger. Since many of these utilities are on street right-of-way, the relocations would probably be noncompensable. However, the fact that utilities exist and must be relocated increases the complexity of easing this curve. Additionally, there is a 46-space municipal parking lot in the northwest quadrant of the intersection. Many alternatives that ease this curve may reduce or eliminate the parking lot. Figure 8.02-1 conceptually illustrates the intersection with respect to the utilities and the parking lot.

8.03 ALTERNATIVES

There are essentially three alternatives that could address this turning radius. The first alternative would leave the intersection geometry intact, relying on a reconstructed Washington Street/1st Street intersection to redirect traffic away from this intersection. The intersection could then remain to carry traffic generated by the parking lots and businesses on this two-block section.

The second alternative would reconstruct the curb radius to a dimension more typical of an arterial. The Wisconsin Department of Transportation's Facilities Development Manual recommends 25-foot radii for urban arterials. It further recommends a 45-foot radii where trucks encroaching on opposing lanes can not be allowed. Since this is a one-way street, the 25-foot radii would be sufficient. The curve could be further eased by painting tapers in the excess pavement to and from the curb radius.

The third alternative would reconstruct the intersection so that it is essentially a turning roadway. With a turning roadway, the direction change for traveling vehicles is made without stopping. The turn is incorporated in the roadway. According to the AASHTO Policy on the Geometric Design of Roadways, a design speed of 20 mph would require a radius of 90 feet. A design speed of 30 mph would require a radius of 275 feet (assuming no super elevation). Figure 8.03-1 shows how these turning radii would affect the intersection and block. One can see that the 275-foot turning roadway would have difficulty fitting within the block.

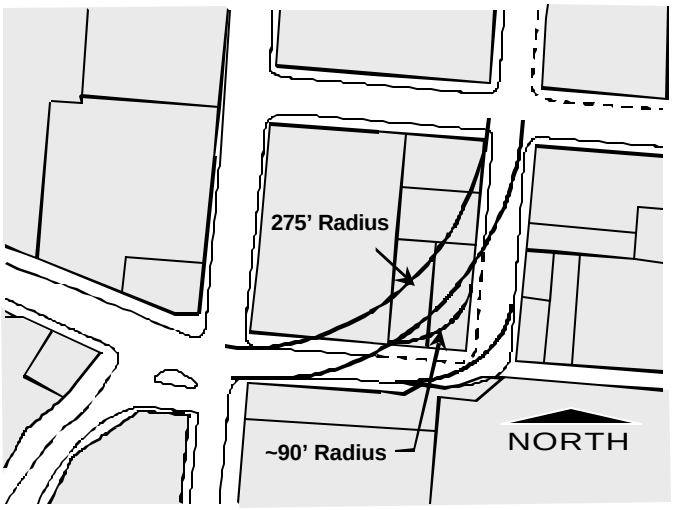


Figure 8.03-1 Turning Roadway Radii

8.04 ALTERNATIVE EVALUATION

Table 8.04-1 summarizes the general effect of the three alternatives. Because of the utility relocations, any improvement has complexity. The larger turning radii associated with Alternative 3 may allow the improvement to avoid the utilities located right at the corner. The power line running north-south on 2nd Street, however, would require relocation. All of the alternatives; however, would have substantial utility relocation costs.

Characteristic	Alternative 1 Existing Radii	Alternative 2 Increased Turning Radii	Alternative 3 Turning Roadway
Turning Speed	Nominal	Nominal	20 to 30 mph
Traffic Calming/Ped Concerns	Traffic calming present	Traffic calming present	Less calming, vehicle mobility emphasized
Parking Impacts	Existing parking maintained	Possible loss of 2 on-street spaces	Loss of up to 46 lot spaces and up to 13 on-street spaces
Utility Impact	None	Many utility relocations required at corner	Corner utility relocations might be avoided, power line relocation likely.

Table 8.04-1 Alternative Comparison Washington Street/2nd Street Intersection

8.05 RECOMMENDATION

The reconstruction of the Washington Street/1st Street intersection will likely alter the primary route to the CBD from the west. This route change will substantially diminish the amount of traffic using this intersection and will likely lessen the concern regarding ease of access to the CBD. Also, since there is a pedestrian mall nearby, increasing vehicle speeds does not appear to be in the best interest of the immediate retail area.

With the reconstruction of the 1st Street/Washington Street intersection, we anticipate many vehicles will use 1st Street to Jefferson Street to enter the CBD. We therefore recommend that no improvement be constructed in the immediate future (Alternative 1). The Washington Street/2nd Street intersection should be monitored after the Washington Street/1st Street is reconstructed. If access ease to the CBD remains a concern, Alternatives 2 or 3 then could be reconsidered.

APPENDIX A
OVERALL TRAFFIC ANALYSIS SUMMARY

APPENDIX B