



# CITY OF RAPID CITY

RAPID CITY, SOUTH DAKOTA 57701-5035

## Growth Management Department

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### MEMORANDUM

TO: Public Works Committee

FROM: Marcia Elkins, Director  
Growth Management Department

DATE: April 4, 2006

RE: Pedestrian/Bicyclist Crash Report 2002 – 2005  
(Information Item Only)

Attached for your information is a copy of the Rapid City Area Metropolitan Planning Organization's (MPO) Pedestrian/Bicyclist Crash Report 2002 – 2005. The Executive Policy Committee has acknowledged receipt of this document. Copies of the document are provided to the Public Works Committee as an information item.

**RECOMMENDATION:** The Executive Policy Committee of the Metropolitan Planning Organization recommends acknowledgement of the receipt of the Pedestrian/Bicyclist Crash Report 2002 – 2005.



EQUAL OPPORTUNITY EMPLOYER

Rapid City Area  
Metropolitan Planning Organization

# **PEDESTRIAN/BICYCLIST CRASH REPORT 2002 - 2005**



Prepared by:

Rapid City Area  
Metropolitan Planning Organization

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## ***INTRODUCTION/PURPOSE***

Nationwide, crashes involving pedestrians and bicyclists account for approximately 13% of all fatal crashes and approximately 4% of all injury crashes. Improving pedestrian and bicyclist safety has been a longstanding challenge to traffic engineering professionals for the following reasons:

- The significant differences in mass and velocity between motor vehicles and pedestrians or bicyclists result in most crashes being fatal or injury crashes. The Federal Highway Administration estimates that collisions with motor vehicles result in serious or fatal injuries to pedestrians in approximately 33 percent of crashes.
- The vulnerability of the under 16-year old age group who have a heavy reliance on pedestrian and bicycle travel as primary modes of transportation.
- The vulnerability of the over-65-year old age group who may rely primarily on pedestrian travel as the primary mode of transportation. This age category characteristically exhibits reduced reaction times and walking speeds and may have a lower threshold for physical injury and a lessened potential for recovery.

The Pedestrian & Bicyclist Crash Report is designated in the Rapid City Area Metropolitan Planning Organization's Operations Plan as one of the transportation products to be presented to the MPO's three transportation process committees. This report is an informational document and as such does not require any formal approval process. The purpose of the Pedestrian & Bicyclist Crash Report is threefold:

1. To present an overview of those reported crashes that involved pedestrians and bicyclists.
2. To present the results of trend analyses of the available crash data.
3. To identify, if appropriate, mitigation measures that would reduce the frequency of crashes involving pedestrians or bicyclists.

In accomplishing these three purposes, the report is clearly consistent with three of the eight planning process factors specified in the recently enacted Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU), specifically:

- Increasing the safety of the transportation system for motorized and non-motorized users.
- Increasing the accessibility and mobility options available to people and for freight.
- Protecting and enhancing the environment, promoting energy conservation, and improving quality of life;

## ***DATA & METHODOLOGY***

The Traffic Operations Section of the Engineering Services Division furnished the background traffic crash reports for this study. The individual reports were reviewed and separate databases developed for pedestrian crashes and bicyclist crashes. Excluded from this analysis were crashes that involved a passenger exiting a moving vehicle or an individual riding or hanging onto a moving vehicle. The location of each crash was then mapped using the City's Geographic Information System (GIS). To aid in analysis, the crash data was linked to the maps so that the details of each crash could be reviewed while looking at the map.

The analysis considered four years of data in the aggregate; this is a departure from the typical traffic engineering practice of considering average annual crash experience in a three year period. This decision was made to promote statistical significance given the limited number of data points within the four year period.

Crash type descriptors were developed based on criteria presented in the Federal Highway Administration's PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System (September 2004) and in the National Highway Traffic Safety Administration's Pedestrian & Bicycle Crash Analysis Tool software. The crash types used in this report are defined below; it is important to note that not every crash type was necessarily represented in the reviewed four years of data.

### **Pedestrian Crash Types**

**Backing Vehicle** - The pedestrian was struck by a backing vehicle on a street, in a driveway, on a sidewalk, in a parking lot, or at another location.

**Bus Related** - The pedestrian was struck by a vehicle while: (1) crossing in front of a commercial bus stopped at a bus stop; (2) going to or from a school bus stop; or (3) going to or from, or waiting near a commercial bus stop.

**Dart/Dash** - The pedestrian walked or ran into the roadway at an intersection or mid-block location and was struck by a vehicle. The motorist's view of the pedestrian may have been blocked until an instant before the impact.

**Driverless Vehicle** – The pedestrian was struck by a driverless vehicle that was left in gear or one that rolled forward or back.

**Multiple Threat/Trapped** - The pedestrian entered the roadway in front of stopped or slowed traffic and was struck by a multiple threat vehicle in an adjacent lane after becoming trapped in the middle of the roadway.

**Non-Roadway** - The pedestrian was standing or walking near the roadway edge, on the sidewalk, in a driveway or alley, or in a parking lot when struck by a vehicle.

**Other** - Pedestrian struck after a vehicle/vehicle collision, pedestrian struck by falling cargo, emergency vehicle striking a pedestrian, pedestrian lying in the road, etc.

**Thru Vehicle No Traffic Control** - The pedestrian was struck at an unsignalized intersection or mid-block location. Either the motorist or the pedestrian may have failed to yield.

**Thru Vehicle, Traffic Control** - The pedestrian was struck at a signalized intersection or mid-block location by a vehicle that was traveling straight ahead.

**Turning Vehicle** - The pedestrian was attempting to cross at an intersection, driveway or alley and was struck by a vehicle that was turning right or left.

Unique Mid-block – The pedestrian was struck while crossing the road to/from a mailbox, newspaper box, or ice cream truck, or while getting into or out of a stopped vehicle.

Unknown – The crash report did not provide adequate information to type the crash.

Walking Along Roadway - The pedestrian was walking or running along the roadway and was struck from the front or from behind by a vehicle.

Working/Playing in Road - A vehicle struck a pedestrian who was: (1) standing or walking near a disabled vehicle, (2) riding a play vehicle that was not a bicycle, (3) playing in the road or (4) working in the road.

### **Bicycle Crash Types**

Assault with Vehicle – The bicyclist was intentionally struck by a vehicle.

Backing Vehicle – The bicyclist was struck by a backing vehicle on a street, in a driveway, on a sidewalk, in a parking lot, or at another location.

Bicyclist Ride Out - The bicyclist was struck at a location where the bicyclist was facing a traffic control device or the bicyclist entered the roadway from an alley or driveway.

Head On – The bicyclist and vehicle directly collided while traveling in opposite directions.

Overtaking Vehicle – The bicyclist was struck by a vehicle that was traveling in the same direction.

Turning Bicyclist - The bicyclist made a right or left turn in front of a vehicle.

Turning Vehicle - The motorist made a right or left turn in front of a bicyclist.

Vehicle Pull Out - The bicyclist was struck at a location where the vehicle was facing a traffic control device or the vehicle exiting from an alley or driveway.

Other – The bicyclist was struck under unusual circumstances.

Unknown – The crash report did not provide adequate information to type the crash.

## **ANALYSIS**

### **Pedestrian Crashes**

#### **Fatal Crashes**

2002 – Fifth Street, north of Omaha Street, Non-Roadway crash. This crash was caused by a minor-aged driver losing control of the vehicle and leaving the roadway, striking the pedestrian on the sidewalk. The crash occurred during daylight conditions, on dry pavement and no alcohol or drug usage was involved.

2005 – Haines Avenue, north of Lawrence Drive, Walking Along Road crash. This crash was caused by a driver driving under the influence of alcohol. The crash occurred during the dawn hours, on dry pavement within a construction zone. The pedestrian was struck when the driver crossed the centerline.

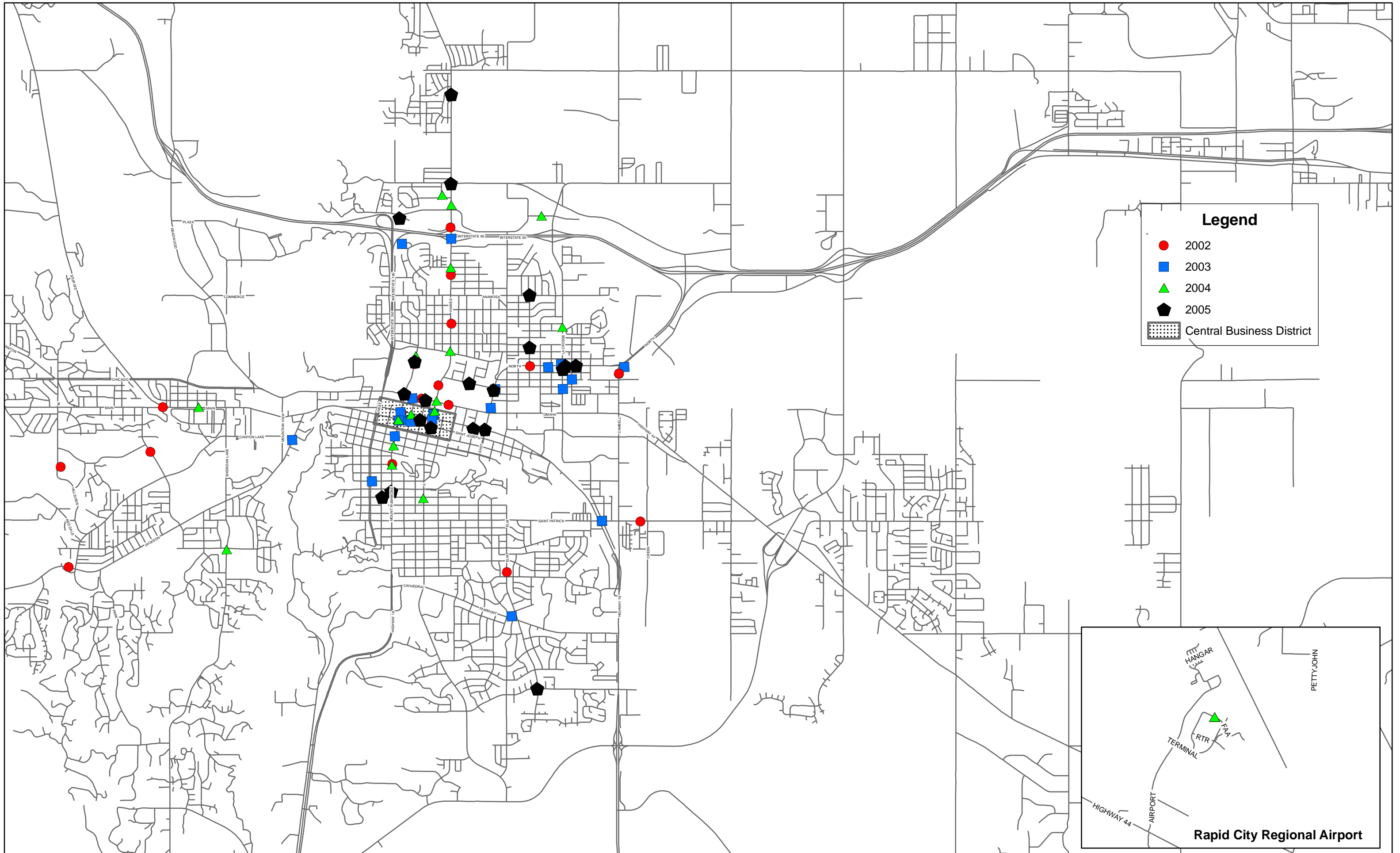
2005 – Mt. Rushmore Road, south of St. Cloud Street, Dart/Dash crash. This crash was caused by a pedestrian stepping into a travel lane. The crash occurred at dusk on dry pavement; alcohol use by the pedestrian was a factor in the crash.

2005 – I-90 near I-190, Dart/Dash crash. This crash was caused by a pedestrian stepping into a travel lane. The crash occurred at night on dry pavement; it is unknown whether or not alcohol use by the pedestrian was a factor in the crash.

#### **Crash Location**

Figure 1 is a mapping of pedestrian crashes occurring in the four year review period. Although no specific type trends were identified from this mapping, the map illustrates that a majority of pedestrian crashes are occurring along the Mt. Rushmore Road and 5<sup>th</sup> Street/Haines Avenue corridors and in the central business district (CBD). A lesser trend can be identified along the East Boulevard/East North Street corridor. The primary reasons for these trends are:

- The amount of commercial development along the corridors
- The density of commercial development within the CBD.
- The relatively high population densities adjacent to each corridor.
- The higher than average number of households along each corridor that do not have vehicles available for personal use.

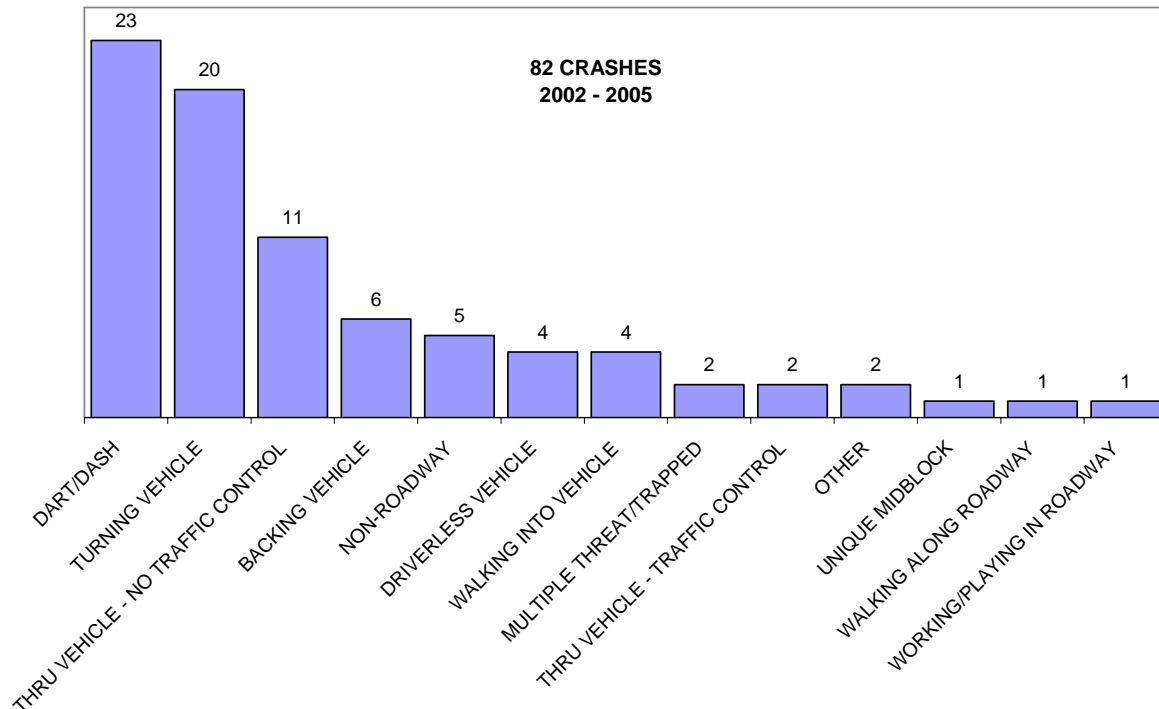


1 inch equals 4,000 feet



## Crash Type

**Figure 2 – Rapid City Pedestrian Crash Types  
By Frequency  
(2002 – 2005)**



Each community is expected to have a unique distribution of crash types owing to the myriad of factors (driver/pedestrian behavior, socio-economic data, etc.) associated with each study area. While stressing the importance of local analysis in identifying problematic patterns, the Federal Highway Administration suggests that nationwide, approximately 75% of pedestrian crashes fall into one of the following seven crash-type categories: Backing Vehicle, Dart/Dash, Non-roadway, Turning Vehicle, Thru Vehicle – No Traffic Control, Thru Vehicle – Traffic Control or Walking Along Roadway. Rapid City's experience has approximately 83% of all crashes falling into one of these types.

The Dart/Dash and Turning Vehicle crashes were chosen to be reviewed in detail based on the number of each that occurred in the four year period (together, these crash types represented approximately 52% of Rapid City's pedestrian crashes). Key findings of the review follow below.

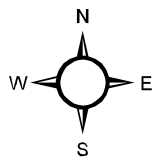
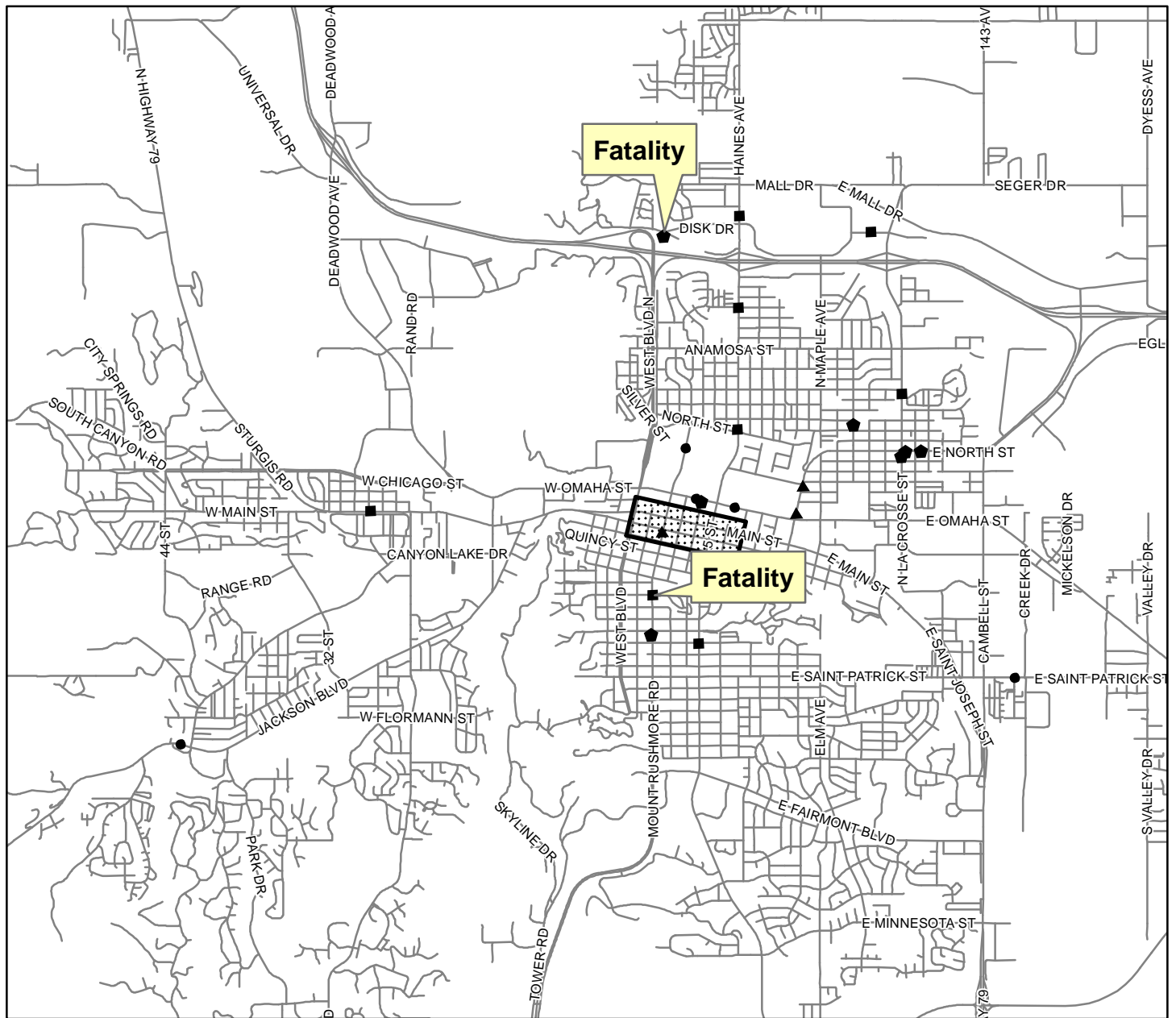
### Dart/Dash

- Dart/Dash crashes were responsible for two of the four pedestrian fatalities occurring in the four year analysis period.
- All of the crashes were judged to be the fault of the pedestrian.
- Eight of the twenty-three crashes involved pedestrians in the 0 to 19 year old age group.
- The youngest pedestrian was 4 years old; the oldest was 75 years old.
- Twelve of the fifteen crashes in the 19 and over age group involved alcohol or drug usage by the pedestrian. No alcohol or drug usage was cited on the part of the identified drivers. Three of the crashes were hit and run cases.
- Figure 3 is a detailed mapping of Dart/Dash crashes. The general trend of crashes occurring along the Mt. Rushmore Road, 5<sup>th</sup> Street/Haines Avenue and East Boulevard/East North Street corridors and in the central business district (CBD) is further illustrated with these crashes.

### Turning Vehicle

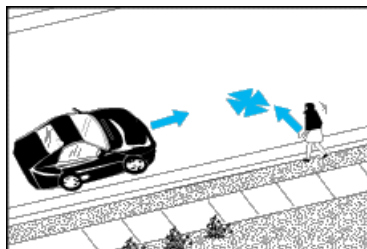
- Eighteen of the twenty crashes were judged to be the fault of the driver; one was the fault of the pedestrian and one was unknown.
- All of the crashes occurred at intersections with some form of traffic control (signal or stop control).
- Eighteen of the twenty crashes occurred within marked crosswalks.
- Fourteen of the crashes occurred during daylight conditions; three drivers cited glare as a contributing factor to the crash. Five crashes occurred during night/lighted conditions; one crash occurred at dusk.

**Figure 3**  
2002 - 2005  
Pedestrian Dart/Dash Crashes  
(23 Crashes)



1 inch equals 5,000 feet

#### Dart/Dash Crash



#### Legend

- 2002
- ▲ 2003
- 2004
- ◆ 2005
- ▤ Central Business District

- None of the crashes involved alcohol or drug usage by the pedestrian. No alcohol or drug usage was cited on the part of the identified drivers. Five of the crashes were hit and run cases.
- Figure 4 is a detailed mapping of Turning Vehicle crashes. Seven of the twenty crashes occurred in the central business district (CBD).

## Crash Rates

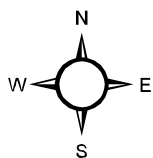
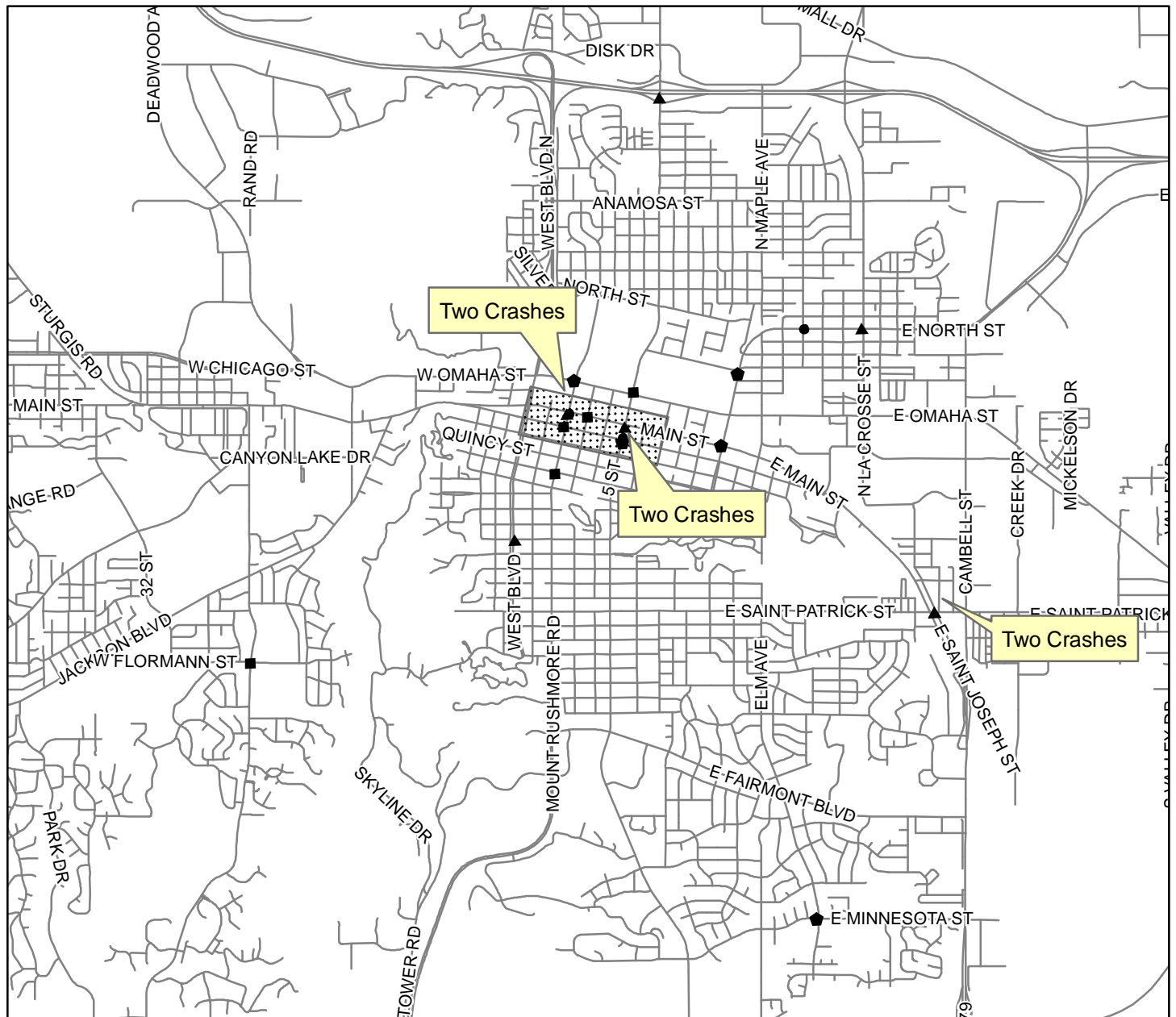
**Table 1 – Comparison of Pedestrian Crash Rates**

	Rapid City				South Dakota		United States	
Year	Injury Crashes	Injury Rate*	Fatal Crashes	Fatality Rate*	Injury Rate*	Fatality Rate*	Injury Rate*	Fatality Rate*
2002	18	29.1	1	1.6	13.7	1.1	24.7	1.7
2003	25	38.1	0	0	11.9	1.3	24.1	1.6
2004	18	28.1	0	0	12.3	1.2	23.2	1.6
2005	17	26.2	3	4.6	N/A	N/A	N/A	N/A

\* Rates expressed as crashes per 100,000 of population.

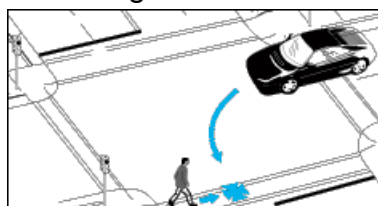
Rapid City's injury crash rate generally exceeds both the statewide and national rates. One factor that must be considered when considering Rapid City versus the entire state is that of urbanization. Rapid City's typically higher traffic volumes, higher population densities and increased opportunities for pedestrian travel may account for such a significant difference. Approximately 17% of the crashes reviewed in the four year analysis period occurred within the defined limits of the central business district. The influence of urbanization is diminished however when comparing Rapid City to the entire nation. A second factor that was considered was pedestrians being under the influence of alcohol or drugs when involved in a crash. For the four year analysis period, approximately 15% of Rapid City's pedestrian crashes cited alcohol or drug usage by the pedestrian; this is consistent with the statewide rate of approximately 14% and the national rate of 15% (as estimated by the Federal Highway Administration).

**Figure 4**  
2002 - 2005  
Pedestrian Turning Vehicle Crashes  
(20 Crashes)



1 inch equals 4,000 feet

Turning Vehicle Crash

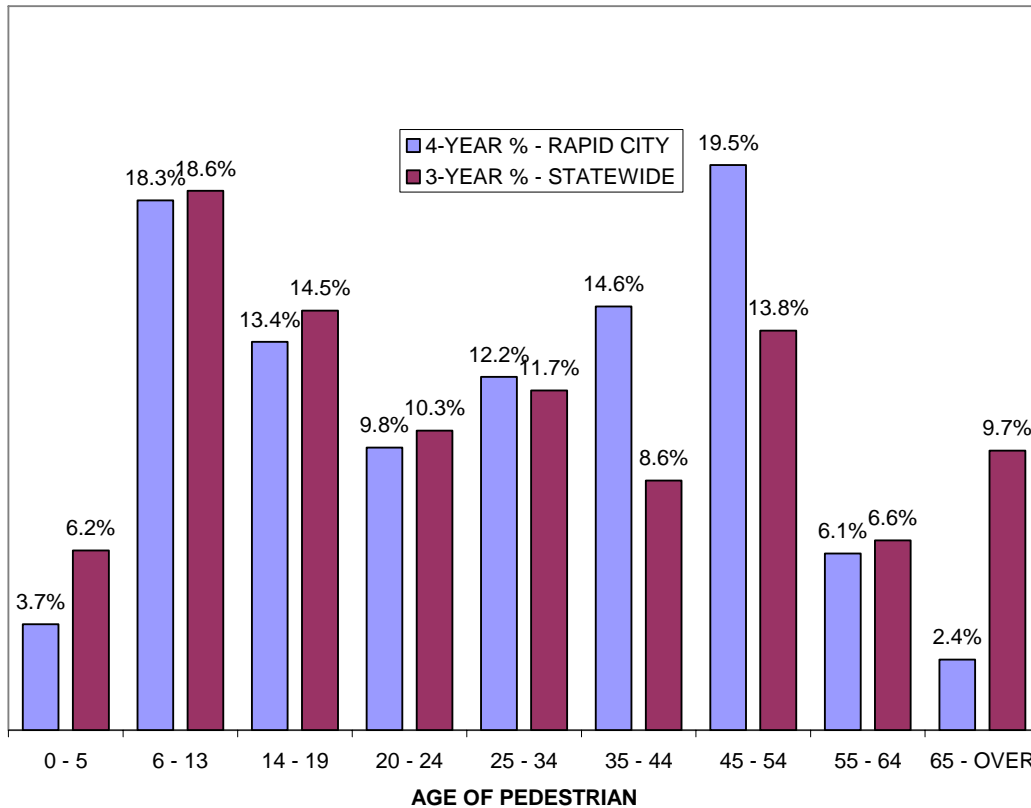


**Legend**

- 2002
- ▲ 2003
- 2004
- ◆ 2005
- ▨ Central Business District

## Pedestrian Age

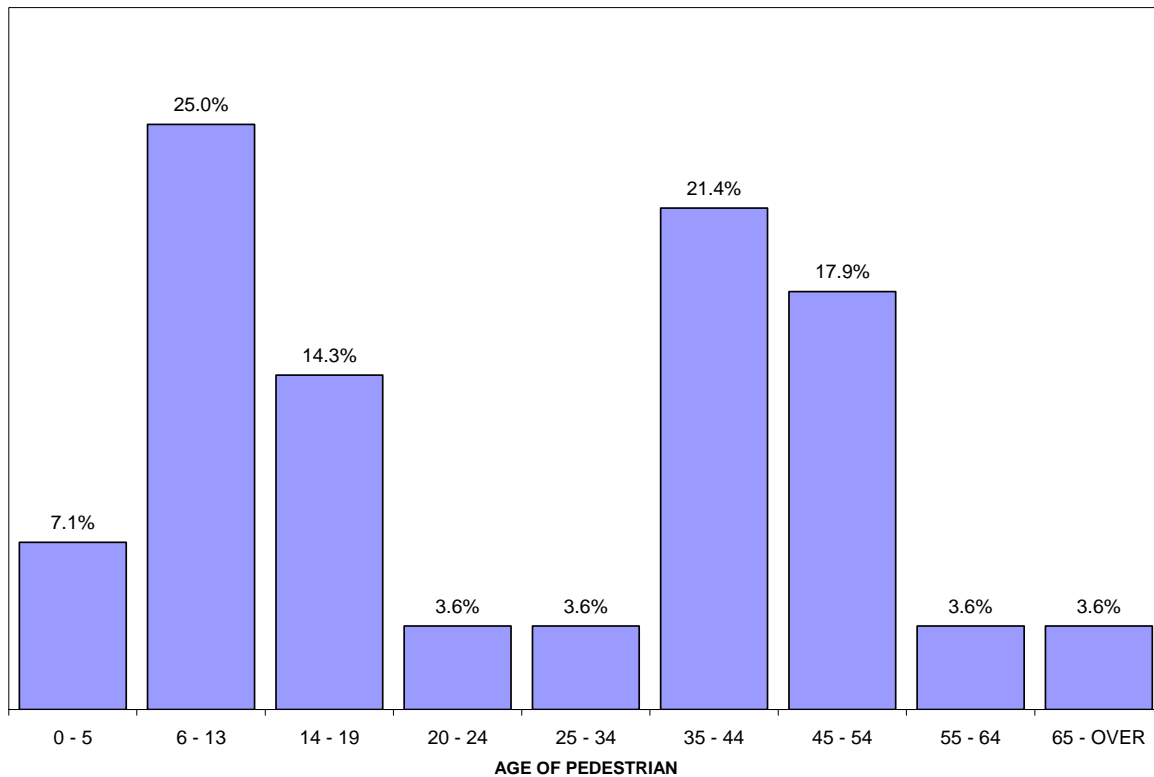
**Figure 5 – Age of Pedestrians in Crashes  
Rapid City vs. Statewide  
(2002 – 2005)**



National data was not included in the analysis of pedestrian age since the age ranges cited by the National Highway Traffic Safety Administration do not correspond to those used by South Dakota. In general, Rapid City's pedestrian crash experience corresponded well with the statewide data. The data points out the vulnerability of the 6 to 19 year old group as they represent 31.7% of pedestrians involved in crashes yet represent only 21.7% of Rapid City's total population. As Figure 6 further illustrates, this age group also comprises the largest percentage of crashes that were the fault of the pedestrian. Rapid City's 65 and over year old group is significantly underrepresented in pedestrian crashes. This is generally consistent with statewide and national trends,

though Rapid City's experience is exaggerated. This positive trend may be attributable to this age group having available both public and private transit options that reduce exposure as pedestrians.

**Figure 6 – Rapid City Pedestrian Crashes  
Responsibility by Age  
(2002 – 2005)**



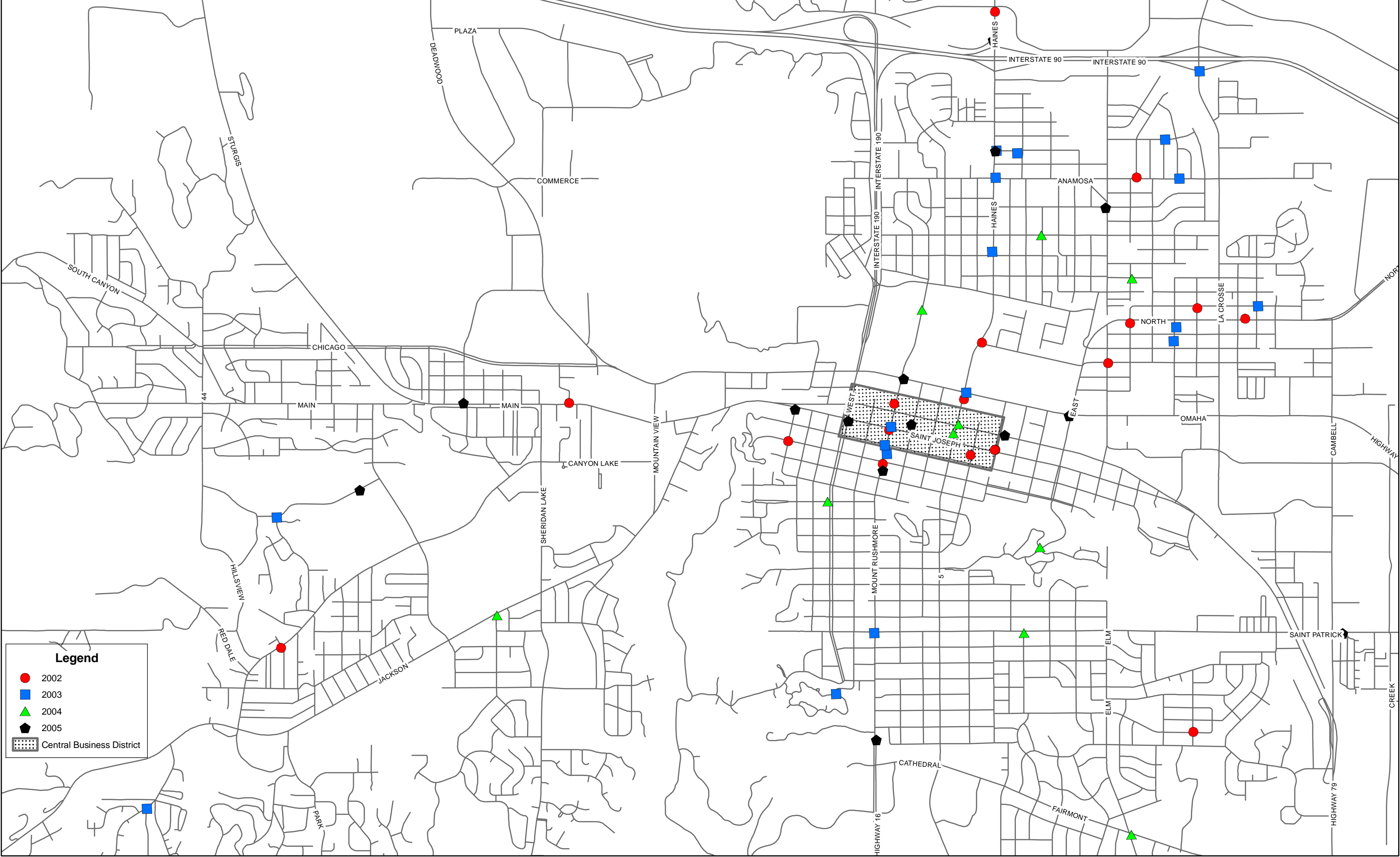
## **Bicycle Crashes**

### **Fatal Crashes**

Rapid City was fortunate to have zero fatal bicyclist crashes in the four years of data analyzed.

2002 - 2005 Bicyclist/Motor Vehicle Crashes

Figure 7

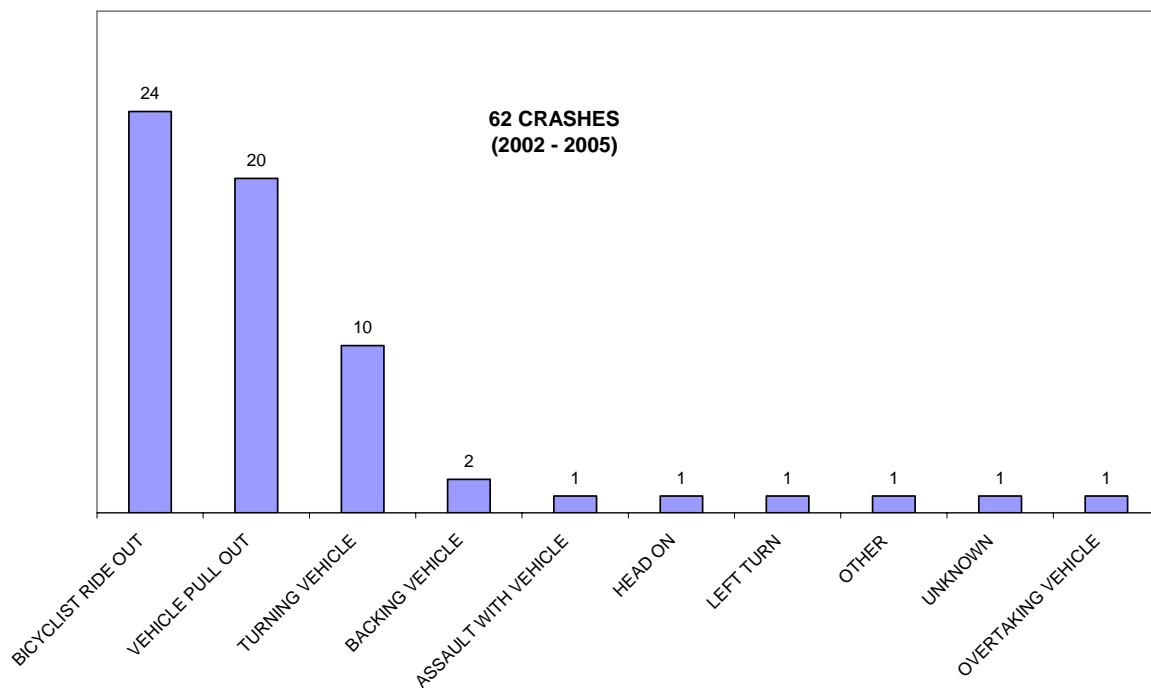


## Crash Location

Figure 7 is a mapping of bicyclist crashes occurring in the four year review period. Similar to pedestrian crashes, the map illustrates that a majority of bicyclist crashes are occurring along the Mt. Rushmore Road and 5<sup>th</sup> Street/Haines Avenue corridors and in the central business district (CBD).

## Crash Type

**Figure 8 – Rapid City Bicyclist Crash Types  
By Frequency  
(2002 – 2005)**



While stressing the importance of local analysis in identifying problematic patterns, the Federal Highway Administration suggests that nationwide, approximately 80% of bicyclist crashes fall into one of the following five crash-type categories: Bicyclist Ride Out, Overtaking Vehicle, Turning Bicyclist, Turning Vehicle, or Vehicle Pull Out. Rapid City's experience has approximately 89% of all crashes falling into one of these types.

The Bicyclist Ride Out, Vehicle Pull Out and Turning Vehicle crashes were chosen to be reviewed in detail based on the number of each that occurred in the four year period. Key findings of the review follow below.

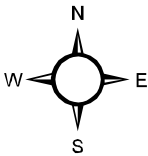
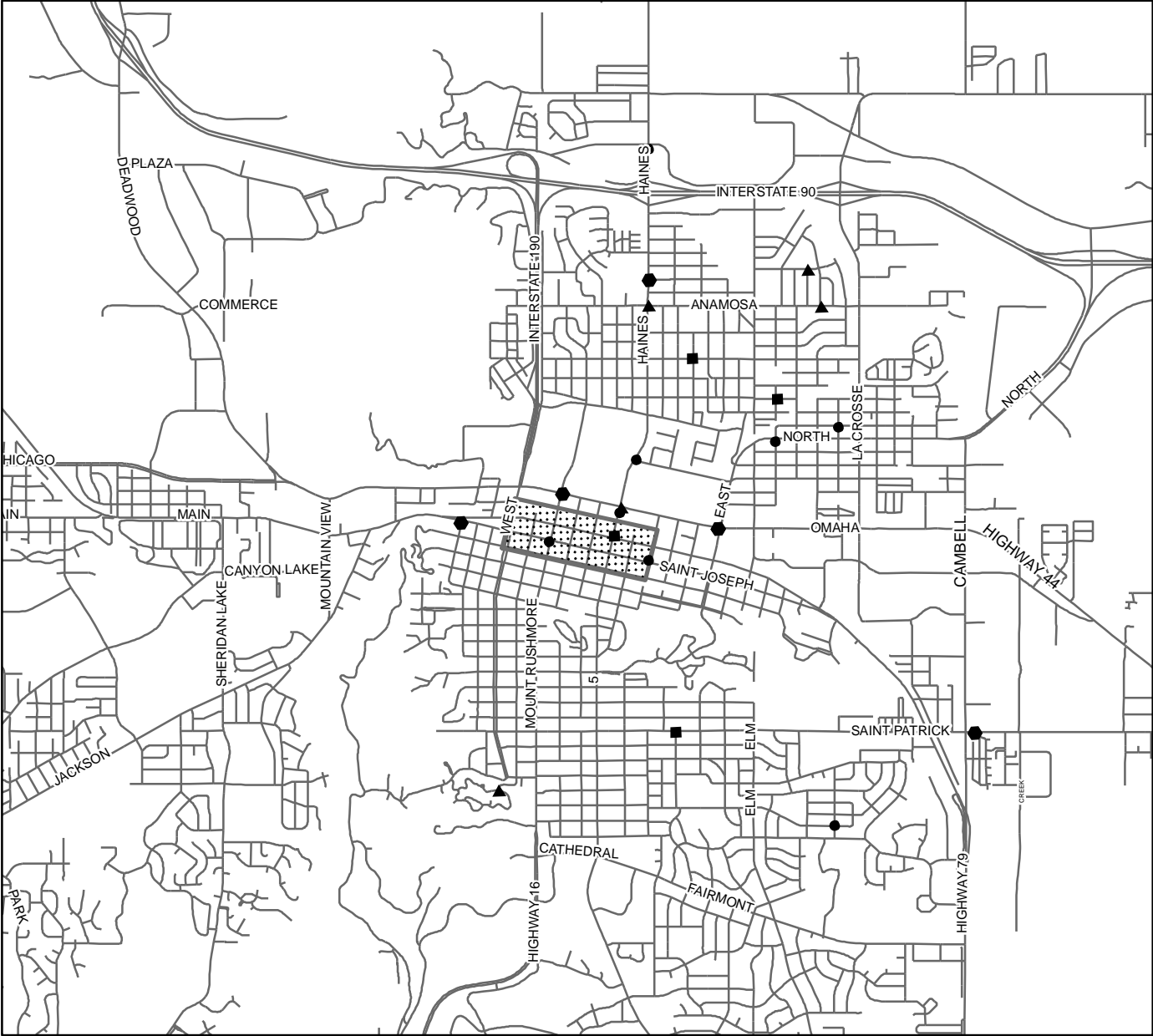
#### Bicyclist Ride Out

- All of the crashes were judged to be the fault of the bicyclist.
- Thirteen of the twenty-four crashes involved the bicyclist riding on the sidewalk and entering the intersection area.
- Fifteen of the twenty-four crashes involved bicyclists in the 0 to 19 year old age group.
- The youngest bicyclists were 6 years old (three crashes); the oldest was 63 years old.
- No alcohol or drug usage was cited on the part of the drivers; alcohol or drug usage on the part of the bicyclist was cited in one crash.
- Figure 9 is a detailed mapping of Bicyclist Ride Out crashes. No crash location trends were identified.

#### Vehicle Pull Out

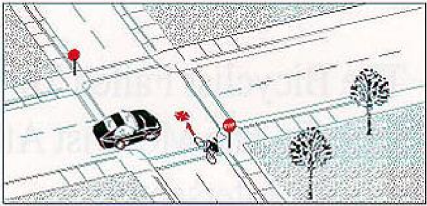
- Nineteen of the twenty crashes were judged to be the fault of the driver. Two bicyclists were cited for riding bicycles on the sidewalk within the central business district (CBD).
- Eighteen of the twenty crashes involved the bicyclist riding on the sidewalk, either mid-block or at an intersection.
- Twelve of the twenty crashes involved bicyclists in the 0 to 19 year old age group.
- The youngest bicyclist was 9 years old; the oldest was 50 years old.
- No alcohol or drug usage on the part of the drivers; alcohol or drug usage was cited on the part of the bicyclist in one crash. One crash was a hit and run.
- All of the crashes occurred during daylight conditions.
- Figure 10 is a detailed mapping of Vehicle Pull Out crashes. Nine of the twenty crashes occurred within, or in near proximity to, the CBD.

**Figure 9**  
**2002 - 2005**  
**Bicyclist Rideout Crashes**  
**(24 Crashes)**




1 inch equals 4,000 feet

**Bicyclist Rideout Crash**

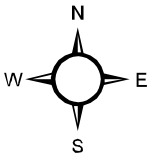
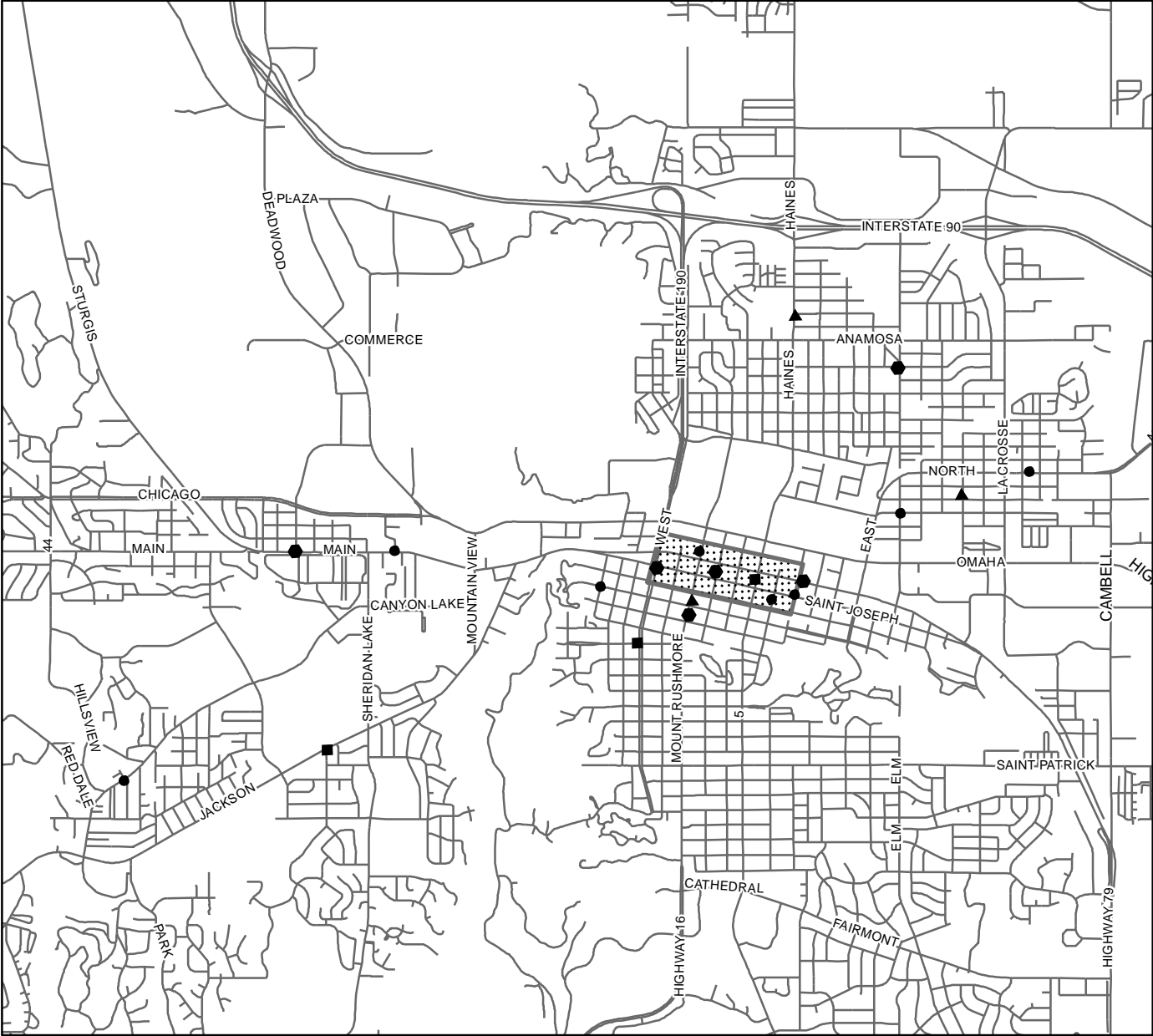


**Legend**

- 2002
- ▲ 2003
- 2004
- ⬡ 2005

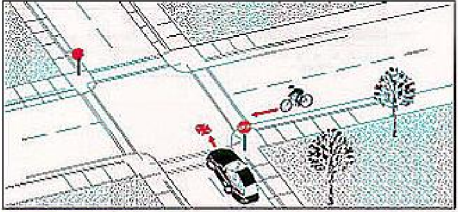
 Central Business District

**Figure 10**  
 2002 - 2005  
 Bicyclist Vehicle Pullout Crashes  
 (20 Crashes)




1 inch equals 4,000 feet

**Vehicle Pullout Crash**



**Legend**

- 2002
- ▲ 2003
- 2004
- ◆ 2005
-  Central Business District

### Turning Vehicle

- Five of the ten crashes were judged to be the fault of the driver; five were judged to the fault of the bicyclist.
- Six of the ten crashes involved the bicyclist riding on the sidewalk and entering the intersection area.
- Six of the ten crashes involved bicyclists in the 0 to 19 year old age group.
- The youngest bicyclist was 9 years old; the oldest was 39 years old.
- No alcohol or drug usage was cited on the part of the bicyclists or drivers. One crash was a hit and run.
- Figure 11 is a detailed mapping of Turning Vehicle crashes. No crash location trend was identified.

### **Crash Rates**

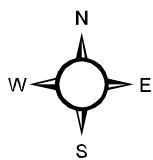
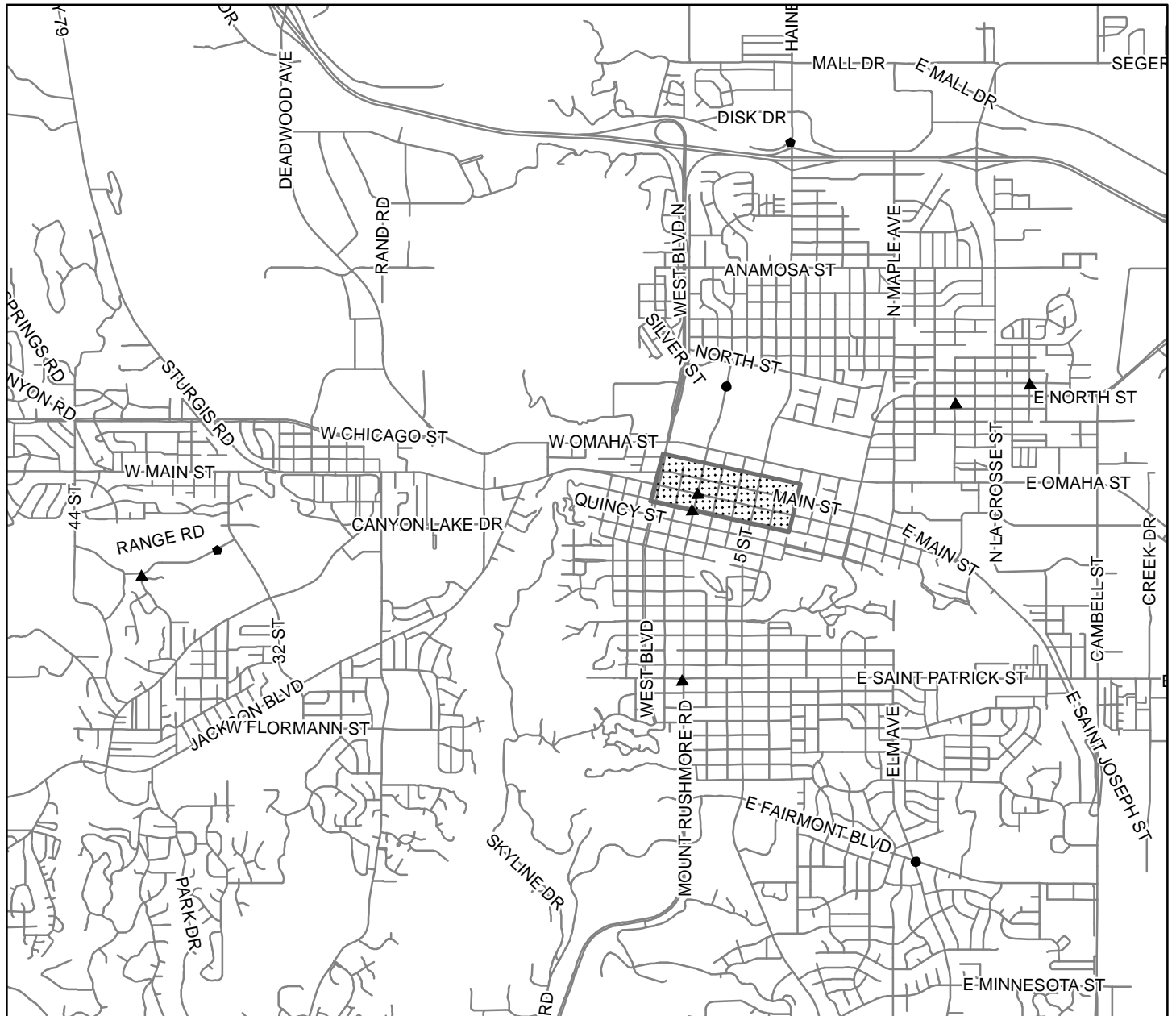
**Table 2 – Comparison of Bicyclist Crash Rates**

	Rapid City				South Dakota		United States	
Year	Injury Crashes	Injury Rate*	Fatal Crashes	Fatality Rate*	Injury Rate*	Fatality Rate*	Injury Rate*	Fatality Rate*
2002	18	29.1	0	0	11.4	0.13	16.7	0.23
2003	18	27.5	0	0	14.3	0.13	15.8	0.21
2004	10	15.6	0	0	10.0	0.13	14.0	0.25
2005	16	24.7	0	0	N/A	N/A	N/A	N/A

\* Rates expressed as crashes per 100,000 of population.

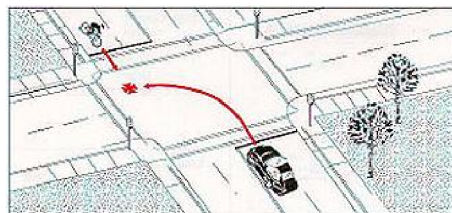
As with pedestrian crashes, Rapid City's injury crash rate generally exceeds both the statewide and national rates. With respect to the comparison with statewide values, Rapid City's urbanization is certainly a factor. Approximately 29% of the crashes reviewed in the four year analysis period occurred within the central business district. Urbanization fails to explain Rapid City's rates exceeding national data. Alcohol or drug use by the bicyclist was identified as a contributing factor in only one crash.

**Figure 11**  
2002 - 2005  
Bicyclist Turning Vehicle Crashes  
(10 Crashes)



1 inch equals 4,000 feet

Turning Vehicle Crash



### Legend

#### CRASH\_TYPE, YEAR

▲ 2003

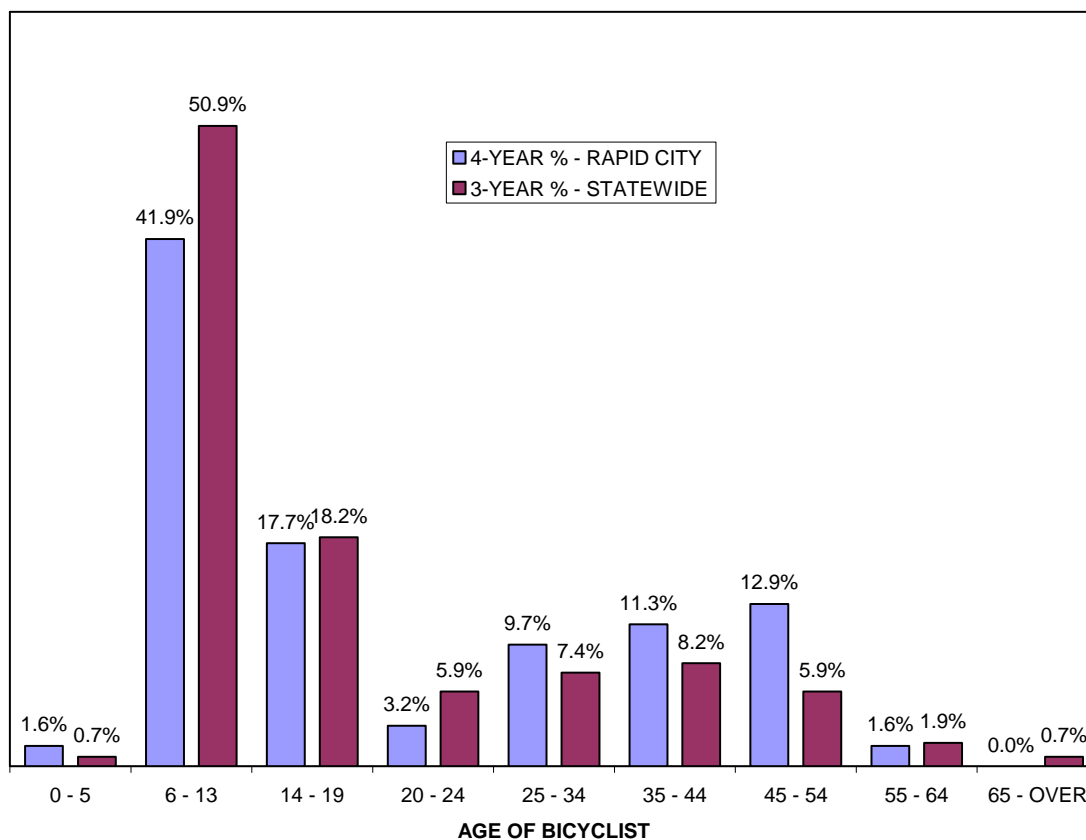
● 2004

◆ 2005

▨ Central Business District

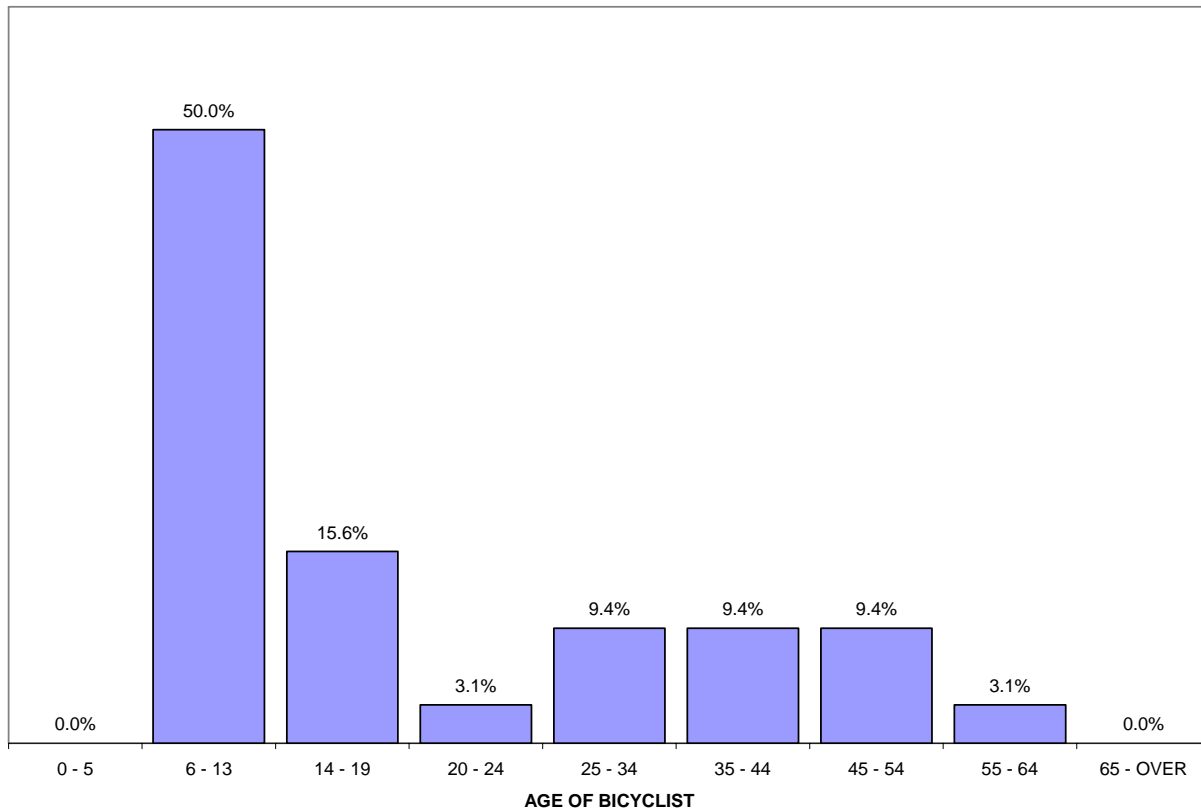
## Pedestrian Age

**Figure 12 – Age of Bicyclists in Traffic Crashes  
Rapid City vs. Statewide  
(2002 – 2005)**



National data was not included in the analysis of bicyclist age since the age ranges cited by the National Highway Traffic Safety Administration do not correspond to those used by South Dakota. In general, Rapid City's bicyclist crash experience corresponded well with the statewide data. The data points out the vulnerability of the 6 to 19 year old group as they represent 59.6% of bicyclists involved in crashes yet represent only 21.7% of Rapid City's total population. As Figure 6 further illustrates, this age group also comprises the largest percentage (65.6%) of crashes that were the fault of the bicyclist.

**Figure 13 – Rapid City Bicyclist Crashes  
Responsibility by Age  
(2002 – 2005)**



## CONCLUSIONS

- Rapid City's pedestrian and bicyclist injury crash rates are significantly higher than corresponding statewide and national rates.
- No location specific trends were identified for pedestrian or bicyclist crashes.
- The under 19 year old age group is overrepresented in both pedestrian and bicyclist crashes.
- The most frequently occurring pedestrian crash types are Dart/Dash and Turning Vehicle.
- Alcohol use is a significant factor in Dart/Dash pedestrian crashes involving the over 19 year old age group.
- The most frequently occurring bicyclist crash types are Bicyclist Pull Out, Vehicle Pull Out and Turning Vehicle.

- A significant number of bicyclist crashes involved bicyclists who were using the sidewalk either mid-block or at an intersection. This suggests that the higher operating speed of bicycles versus pedestrians (1) makes it difficult for drivers to judge the necessity of yielding to bicyclists, and, (2) allows for bicyclists to pass slowing vehicles approaching an intersection leading to drivers being “surprised” by crossing bicycle traffic at the intersection.

## RECOMMENDATIONS

- A priority should be placed on efforts to educate pedestrians, bicyclists and drivers about safety practices associated with non-motorized modes of transportation. A particular emphasis should be placed on programs to effectively reach the under 19 year-old age group. The recently enacted Safe Accountable Flexible Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU) included provision for creating a Safe Routes to School program. This program will be administered through the South Dakota Department of Transportation and should be investigated as a possible source of funding to support such an enhanced outreach program. Additional consideration should be given to educational efforts related to the risks associated with pedestrians under the influence of alcohol.
- The Manual on Uniform Traffic Control Devices allows for the use of TURNING TRAFFIC MUST YIELD TO PEDESTRIANS (R10-15) regulatory signs at signalized intersections and the City has installed such signing at two locations in the central business district (CBD), Mt. Rushmore Road/Main Street and St. Joseph Street/5<sup>th</sup> Street. To further promote pedestrian safety, the City has also prohibited right turns on red within the CBD. Given Rapid City’s pedestrian crash experience it is recommended that the policies that govern sign placement in the CBD be reevaluated.
- Additional resources to expand the citywide maintenance program for crosswalk markings should be identified and implemented.