

Iron Mountain Quarry

Traffic Impact Analysis

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Iron Mountain Quarry
Jefferson County

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Introduction

This report summarizes a traffic analysis for a proposed Iron Mountain Quarry that would be located off of State Route (SR) 104 in Jefferson County, Washington. The site is located in Jefferson County Washington approximately three miles west of the Shine area, to the north of State Route (SR) 104 and to the east and southeast of the existing Shine Quarry. The site is served by the Shine Quarry Road, a private road that forms the north leg of an existing access located on SR 104 at milepost 9.85. The south leg of this intersection (Rock-to-Go Road) is also a private road serving the Fred Hill Materials/ Miles Sand and Gravel operations to the south of SR-104. The location is illustrated in Figure 1.

This analysis presents the transportation element of the documentation that is being prepared as part of the environmental review process for the proposed development. The purposes of this analysis are to identify traffic related impacts generated by the operation of this proposed action and, where appropriate, to outline policies and/or physical improvements to minimize or eliminate the effects of these impacts.

This report is organized to first present a description of the proposed project followed by an evaluation of existing conditions to establish a baseline against which the proposed project can be evaluated.

Project Description

Iron Mountain Quarry proposes to mine, crush, and screen mineral products. The project will include construction of a gated office/shop complex including truck scales, equipment maintenance and storage building, employee parking, a truck parking area, and a wholly contained diesel fuel tank. Loaders and related mine equipment will be fueled on-site. Iron Mountain Quarry will not maintain a truck fleet to deliver materials. Quarry customers will pick up and haul material from the site.

During the first few years of operations the mine could produce as much as 200,000 tons of mineral product per year. By year five, when the quarry is fully operational, up to 400,000 tons per year could be produced depending upon market conditions. It is assumed that the quarry would operate approximately 275 days per year. This operating schedule assumes that there would be occasional closures due to inclement weather as well as holiday and Sunday closures. The quarry would be open on Saturdays. The demand for materials is spread fairly evenly throughout the year and

there would be between eight and ten employees based at the site. Material would leave the site in single unit or truck with trailer combinations with an average load of 27 tons of material. The trucks used to haul materials would be based off-site and would not be operated by Iron Mountain Quarry.

Daily operations would begin with the arrival of as many as ten employees followed by the arrival of trucks to pick-up material for delivery. Approximately 65% of the daily tonnage would leave the site by noon with the remaining 35% leaving the site between noon and 4:30 PM. Employees would leave the site around 4:30 PM.

Traffic Analysis

Existing Conditions

Figure 1 illustrates the location of the proposed development and its relationship to SR 104 and existing AM peak hour turning movement volumes at the intersection. This access is currently shared with the Shine Quarry. The south leg of the intersection serves the Fred Hill Materials/ Miles Sand and Gravel operations to the south. The traffic volumes on the south leg of the intersection represent existing AM peak hour traffic volume generated by Fred Hill Materials/ Miles Sand and Gravel operations.

In the vicinity of the existing connection, SR 104 consists of two 11-foot travel lanes and 8-foot wide paved shoulders on both sides of the road. The posted speed limit is 60 mph and there are no significant vertical or horizontal curves.

Traffic Volumes

This segment of SR-104 carries approximately 13,000 vehicle trips per day (WSDOT annual average, 2008). To establish peak hour volumes at the access, an AM peak hour turning movement count was made on September 10, 2009 between 6:30 and 9:30 AM. The counts showed an AM peak hour westbound volume of approximately 400 vehicles and a somewhat higher eastbound volume of approximately 460 vehicles on SR 104. The volume turning onto or off of SR 104 from the minor approaches was approximately 10 vehicles on each approach during the AM peak hour. The volume of traffic on the minor approaches reflects current economic conditions and is likely to increase as the demand for materials increases with the economic recovery. A review of historic production levels for the Fred Hill Materials Quarry and the Shine Quarry show that both quarries are currently processing a smaller amount of material than in 2006 and 2007. At the Fred Hill Materials Quarry a comparison of 2006 and 2007 average monthly production with 2008 and 2009 levels shows that production dropped by 40% in 2008 and dropped

by 46% for the first 5 months of 2009. A comparison of Shine Quarry 2006 and 2007 average monthly production levels with 2008 and 2009 levels shows that production dropped by 26% in 2008 and 57% for the first 9 months of 2009. Traffic volumes turning into or out of the Fred Hill approach (northbound) to the intersection were increased by 54% while volumes turning into or out of the Shine Quarry (southbound) approach were increased by 43% to reflect this adjustment (see Table 1). The percentage of vehicles that were heavy trucks was 17% westbound and 14% eastbound. The adjusted turning movement counts will be used as a baseline in this analysis to evaluate intersection operations. Figure 1 illustrates existing, adjusted existing, and forecasted AM peak hour traffic volumes.

Table 1: Existing (2009) & Adjusted (2009) AM Peak Hour Turning Movement Counts at SR 104 & Shine Quarry Road/Rock-to-Go Road

Approach		Sept. 10, 2009 count	Adjustment	Adjusted Existing Conditions	% Heavy Vehicles
EB	L	0	0	0	0%
	T	450	0	450	8%
	R	0	0	0	0%
WB	L	5	3	8	60%
	T	396	0	396	17%
	R	4	2	6	100%
NB	L	3	2	5	67%
	T	1	1	2	0%
	R	2	1	3	100%
SB	L	4	2	6	100%
	T	1	0	1	100%
	R	1	1	2	100%
Total		867	12	879	14%

The percentage of vehicles that were heavy trucks was 17% westbound and 8% eastbound. On the minor approaches to the intersection almost all of the vehicles turning onto or off of SR 104 were heavy trucks.

Level of Service & Queuing

While traffic volumes provide an important measure of activity on the area road system, it is important to determine the ability of an intersection to accommodate these traffic volumes. Intersections generally limit the capacity of street networks because they create focused locations where most conflicting traffic movements must

share available road space. Therefore, intersection performance serves as the primary measure of traffic flow quality. Level of service (LOS) is a measure of an intersection's ability to accommodate the traffic that it serves. The Transportation Research Board developed the LOS methodology used in making this evaluation and it is summarized in the year 2000 Highway Capacity Manual (HCM).

The HCM year 2000 methodology is based on total seconds of delay due to the presence of intersection controls, or "control delay." Level of service is defined by seconds of average vehicle delay. Intersection performance is divided into six grades ranging from "A," which is very good, to "F," which reflects a breakdown in traffic flow. The level of service category breakdown by control delay is summarized in Table 2.

Table 2: Intersection Level of Service Categories

Level of Service Grade	Traffic Signal Control Intersections Delay (sec)	Minor Approach Control Intersections Delay (sec)
A	<10	<10
B	10-20	10-15
C	20-35	15-25
D	35-55	25-35
E	55-80	35-50
F	>80	>50

WSDOT facilities in rural areas have a level of service threshold of LOS-C as described in Chapter 4 of WSDOT's Development Services Manual (2005).

TSI examined intersection level of service (LOS) at the site access. Intersection level of service calculations were performed using the Synchro, version 7 computer program which incorporates the methodology described above. Intersection levels of service are calculated using the AM peak hour traffic volumes illustrated in Table 1 for 2009 adjusted existing conditions. The uncontrolled through movements on SR-104 operate at LOS-A while the stop controlled southbound movement that serves the project site operates at LOS-D with an average of 28 seconds of delay per vehicle. The stop controlled northbound approach to the intersection operates at LOS-C with an average of 22.5 seconds of delay per vehicle. As noted above in the discussion of traffic volumes, both of the controlled approaches carry very low volumes and there is little if any queuing. The calculated 95th percentile queue on the southbound approach is 10 feet and 6 feet on the northbound approach.

The delay experienced by vehicles turning onto SR 104 is due to the heavy through volumes which limit the frequency and duration of gaps in the uncontrolled traffic flow. The lack of sufficient gaps increases delays for entering vehicles as they wait for an adequate gap to safely enter the highway. The signalized intersection at SR

104/ Beaver Valley Road (SR-16), approximately 1 mile to the west, creates gaps in the traffic flow on SR 104. However, given the distance from the subject intersection, it is likely that most of the gaps dissipate and are of little benefit to vehicles entering SR-104 at the Shine/Fred Hill quarry access. An analysis of the intersection using SimTraffic shows that the average vehicle delay on the southbound approach is approximately 16 seconds and 15 seconds on the northbound approach. The Syncho and SimTraffic reports may be found in the appendices to this report.

Collision Analysis

Collision data for the segment of SR 104 from milepost 9.5 to 10.5 was obtained from WSDOT for the period of January 1, 2006 to December 31, 2008. This segment includes the intersection serving the project site. There was one collision on this road segment in 2006, three in 2007, and none in 2008. Two of the collisions were at mileposts 9.8 and 9.94 which are near the site access at milepost 9.85. Both were rear end collisions with a stopped vehicle so it may be assumed that they were intersection related. One of these occurred late at night and involved alcohol while the other occurred at midday.

The four collisions may be summarized as: a rear end collision that was alcohol related, a rear end collision with a stopped vehicle, a head on collision involving unsafe speeds, and a vehicle leaving the roadway due to unsafe speed. The four collisions result in an average of 1.3 collisions per year on this one-mile segment of SR 104. This equates to collision rate of 0.27 collisions per million vehicle miles. Typically, high collision locations for street segments are indicated when collision rates exceed 10.00 collisions per million vehicle miles traveled.

Future Conditions without the Proposed Project

Traffic Volumes

A review of WSDOT daily traffic volumes for this segment of SR 104 shows that daily volumes have remained fairly stable at 13,000 vehicles per day. For the purposes of this analysis it is assumed that vehicle volumes will remain at existing levels.

Other Projects

Plans to expand mineral extraction operations in areas served by the south leg of the subject intersection have been proposed but are currently being refined or delayed. Expansion in this area would likely be associated with the construction of the Pit to

Pier project would provide marine facilities to export material via barge throughout the Puget Sound region. Potential projects also include expansion of existing and new mineral extraction areas with conveyor systems to transport material to a central location for processing. The 'Wahl Extraction Area Transportation Report' (June 2003) prepared by Reid Middleton for Fred Hill Materials summarized transportation conditions associated with this development. The proposed development of new mineral extraction areas and increased demand for materials would result in additional traffic volumes at this access. The 2003 traffic study shows that during the AM peak hour there was not any traffic on Rock-to-Go Road at its intersection with SR-104 and that the project would result in 10 new trips assigned to this leg of the intersection. Current counts (2009) show that 10 vehicles are turning onto or off of SR-104 at Rock-to-Go Road during the AM peak hour. This is consistent with what was forecasted in the 2003 traffic analysis. It should also be noted that 2009 through volumes on SR-104 are less than what was documented in the 2003 study. Furthermore the 2003 study forecasted a 7.7% annual increase in traffic volumes at this location which has not materialized. For the purposes of this analysis, the existing conditions (2009) incorporate trips forecasted by the Wahl Extraction Area project.

A comparison of historic average daily traffic volumes on SR-104 between 2001 and 2008 shows that daily traffic volumes have remained stable at approximately 13,000 vehicles per day. It is assumed that existing traffic volumes will remain stable and adjustments to reflect an annual growth in background traffic volumes are not warranted.

Traffic Operations

For the purposes of this analysis, it is assumed that traffic volumes on the south leg of the intersection (Rock-to-Go Road) will remain at current levels as summarized in Table 1 and that future (2014) traffic operations at the project site access would not change from existing conditions as summarized in Table 1.

Future Conditions with the Proposed Project

Trip Generation

Trip generation characteristics for truck trips are calculated by breaking down the annual tonnage into daily and peak hour truck trips using the assumptions described under the project description section of this report. At a production level of 200,000 tons per year there would be 54 daily truck trips (200,000 tons/ 275 days/ 27 tons per trip*2). At a production level of 400,000 tons per year the quarry would generate up to 108 truck trips per day. A trip is defined as a one-way trip.

The next step in the process was to calculate the number of truck trips that the

project would generate during the AM and PM peak hours. Based on similar operations it is estimated that up to 65% of the daily material would be delivered between 7 AM and noon and that the remaining 35% would be delivered between noon and 4:30 PM. Based on this assumption, 13% (65% / 5 hours) of the material would be delivered during the AM peak hour and 8% (35% / 4.5 hours) during the PM peak hour. The number of AM and PM peak hour truck trips can be calculated by multiplying these percentages times the number of average weekday truck trips. It is assumed that all inbound trucks would also leave the site during the peak hour. This calculation results in 7 AM peak hour truck trips and 4 PM peak hour truck trips at a production level of 200,000 tons per year. At a production level of 400,000 tons per year there would be 14 AM and 9 PM peak hour truck trips.

Daily operations would begin with the arrival of employees followed by the arrival, loading, and departure of trucks carrying material. However, in order to provide a conservative analysis, it is assumed that employees are arriving and trucks are both arriving and departing within the AM peak hour. As daily operation end in the late afternoon most employees would leave the site prior to the PM peak hour. A few employees would remain on-site to load the last trucks, manage the scale, and service equipment. It is estimated that up to three employees would leave the site during the PM peak hour. The trip generation forecast is summarized in Table 3.

Table 3: Trip Generation Summary

Generator	200,000 Tons/ Year					400,000 Tons/ Year				
	Daily	AM Peak		PM Peak		Daily	AM Peak		PM Peak	
		In	Out	In	Out		In	Out	In	Out
Employees	20	10	0	0	3	20	10	0	0	3
Trucks	54	4	3	2	2	108	7	7	4	5
Totals	74	14	3	2	5	128	17	7	4	8

Trip Distribution and Assignment

The assignment of AM peak hour project generated trips is based on the distribution of existing traffic volumes where most of the truck turning movements at the intersection are traveling to and from the west. A portion of the employee trips could originate from points north (Port Townsend, Port Ludlow) and access the site via the Shine Quarry road connection with Beaver Valley Road to the west. Trips using this route would not impact SR-104. However, for the purposes of maintaining a conservative analysis it is assumed that all project trips will access the site via SR-104. Table 4 summarizes the distribution of project trips at the site access and 2014 AM peak hour with project traffic volumes at the intersection.

Table 4: AM Peak Hour Trip Assignment – SR 104 & Rock-to-Go Road/ Shine Quarry Road

Approach		2014 Without Project	Project Trip Assignment	2014 With Project	% Heavy Vehicles
EB	L	0	3	3	0%
	T	450	0	450	8%
	R	0	0	0	0%
WB	L	8	0	8	60%
	T	396	0	396	17%
	R	6	14	20	100%
NB	L	5	0	5	67%
	T	2	0	2	0%
	R	3	0	3	100%
SB	L	6	6	12	100%
	T	1	0	1	100%
	R	2	1	3	100%
Total		879	24	903	14%

Level of Service & Queuing

A level of service analysis was completed for the AM peak hour using Synchro 7.0 software for two-way stop controlled intersections. The results of this analysis (See Table 5) show that the southbound controlled approach would continue to operate at LOS-D with 33 seconds with an average of 33 seconds of vehicle delay and the controlled northbound approach would continue to operate at LOS-C.

Jefferson County maintains a level of service standard of LOS-D for the purposes of meeting concurrency requirements. This standard is met.

The vehicle queue on the southbound approach would increase from 10 to 21 feet or approximately one vehicle.

Table 5: AM Peak Hour Level of Service - SR 104 & Rock-to-Go Road/ Shine Quarry Road

Approach	Existing Conditions		Future (2014) With Project Conditions	
	LOS (Delay)	Max Queue (ft.)	LOS (Delay)	Max Queue
Eastbound	A (0.0)	0	A (0.1)	0
Westbound	A (0.3)	1	A (0.3)	1
Northbound	C (22.5)	6	C (23.1)	6
Southbound	D (28.0)	10	D (32.8)	21

Safety

The analysis of collision data for this segment of SR-104 did not indicate the presence of any safety issues. Increases in truck volumes turning off of or onto SR-104 at the subject intersection could increase the potential for rear end collisions caused by inattentive or speeding drivers that fail to react to trucks entering the highway or trucks slowing to turn off of the highway.

Sight distance for vehicle entering SR-104 is approximately 1,690 feet to the west and 2,006 feet to the east (Wahl Extraction Area Traffic Analysis 2003).

Combination trucks turning onto the highway from a stopped position require 1,390 feet of sight distance. Sight distance requirements are met. The fact that there is adequate sight distance and that truck operations occur during daylight hours reduces the potential for collisions.

Section 1310.07 of the WSDOT Design Manual (June 2009) establishes guidelines for providing channelization of at grade intersections. Relevant elements include right turn lanes, left turn lanes, and speed change lanes.

With a peak hour through volume of 400 vehicles and a peak hour right turn volume of 20 vehicles it is not necessary to provide a right turn pocket, taper, or lane (*See Exhibit 1310-15, page 1320-37 WSDOT Design Manual, June 2009*). Furthermore, there is adequate sight distance and no history of collisions that would indicate that a right turn lane is warranted.

Guidance for left turn lanes is found on page 1310-13 of the WSDOT Design Manual. Key factors are congestion reduction, safety, restrictive geometrics, and inadequate sight distance. The level of service analysis (see Table 5) shows that the eastbound movement is forecasted to operate at LOS-A with less than one second of delay. There is no significant history of collisions at the intersection that involve left turning vehicles. The radii on the minor approaches are very generous so geometrics are not restrictive. There is adequate sight distance. Based on these conditions, a left turn lane is not recommended.

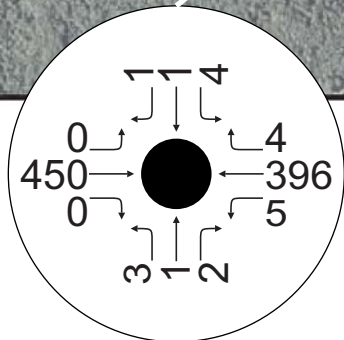
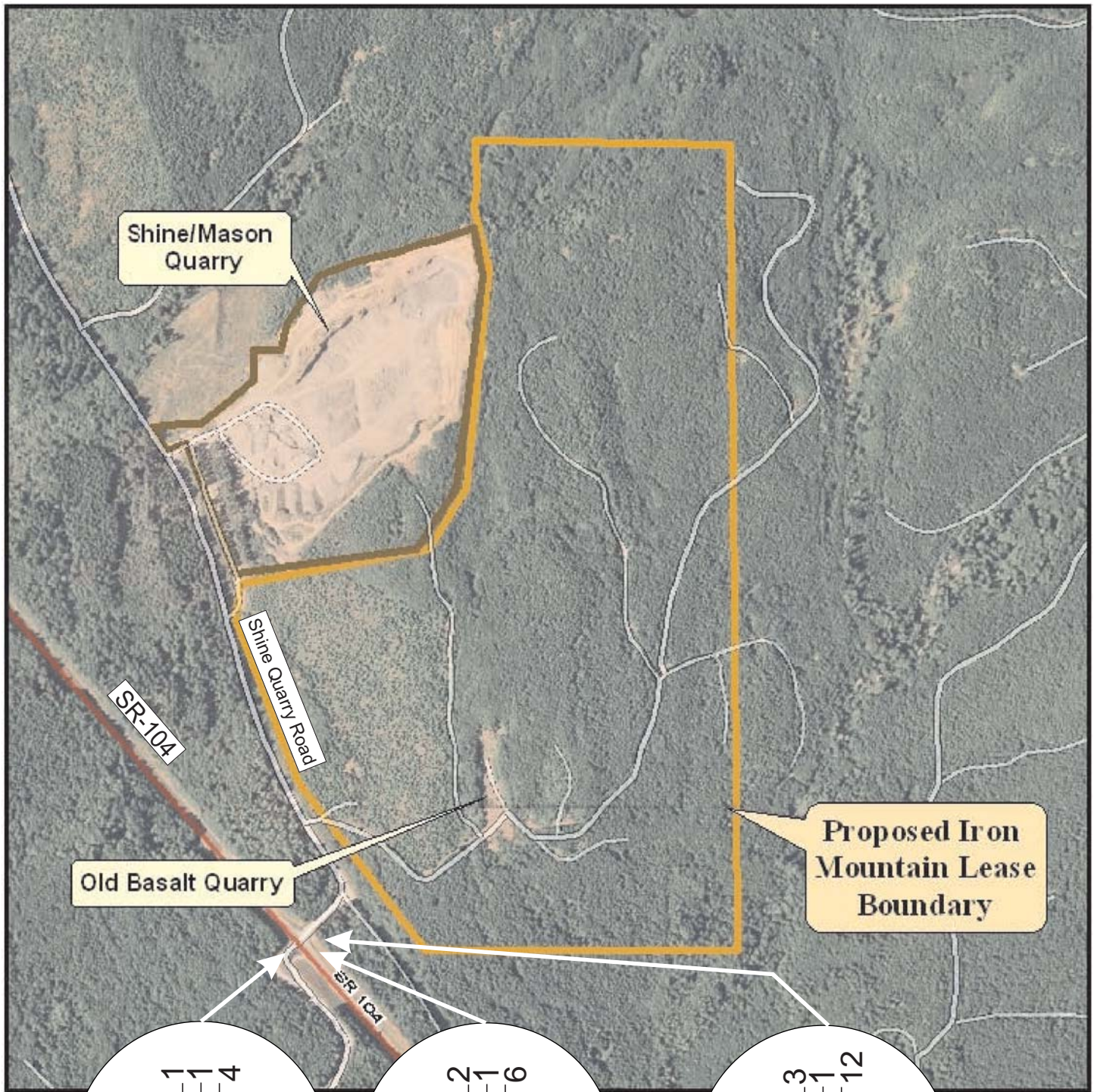
Speed change lanes are auxiliary lanes used primarily for acceleration or deceleration when entering or leaving a highway. Deceleration lanes are advantageous because they remove slowing vehicles from the through travel lane. Acceleration lanes are less useful since entering drivers can wait for a gap in the through traffic flow. The WSDOT Design Manual (See page 13-10-16) does not provide quantifiable criteria to evaluate the need for speed change lanes. Factors mentioned include, speed, traffic volumes, capacity, type of highway, design and frequency of intersections, and collision history. Given the relatively low volumes generated by the existing Shine Quarry and the proposed Iron Mountain Quarry there does not appear to be sufficient volumes to warrant speed change lanes. The collision history also does not reveal a safety deficiency. In addition, the existing intersection has been safely serving rock quarries for many years without significant impact to through traffic.

Based on this evaluation there does not appear to be a need for this project to provide turn or speed change lanes at the existing access.

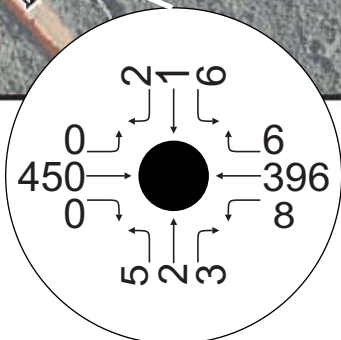
Conclusions

Traffic generated by the proposed project would not affect level of service on SR-104. The volume of truck traffic generated by existing and proposed operations do not indicate that a center left turn lane, speed change lanes, or right turn lane are warranted. A review of collision data on the road segment combined with an evaluation of sight distance and intersection geometrics concludes that there are no identified safety deficiencies at the intersection.

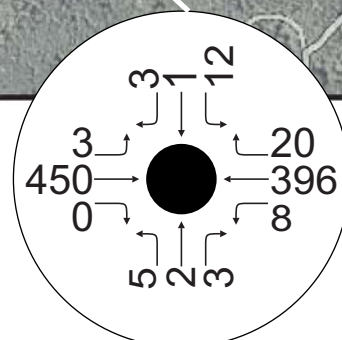
Based on this analysis the proposed project would add a small number of trips to the intersection and there would be no adverse impacts requiring mitigation.



Existing Conditions (2009)



Adjusted Existing Conditions (2009)



Forecasted Conditions (2014)

Figure 1:
Project Location &
SR-104/ Shine Quarry Rd.
AM Peak Hour Traffic Volumes

Iron Mountain Quarry
Port Ludlow, WA