

HAZUS-MH: Earthquake Event Report



Region Name: *Rio Grande County*

Earthquake Scenario: *Cannibal M7.0 CEUS Event*

Print Date: *January 31, 2006*

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Colorado

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 911.45 square miles and contains 4 census tracts. There are over 4 thousand households in the region and has a total population of 12,413 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 666 (millions of dollars). Approximately 99.00 % of the buildings (and 87.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 912 and 129 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 4 thousand buildings in the region which have an aggregate total replacement value of 666 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 62% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 9 schools, 2 fire stations, 4 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 4 dams identified within the region. Of these, 1 of the dams are classified as 'high hazard'. The inventory also includes 3 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 1,041.00 (millions of dollars). This inventory includes over 138 kilometers of highways, 70 bridges, 3,769 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	70	24.90
	Segments	20	583.60
	Tunnels	0	0.00
	Subtotal		608.50
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	57	66.50
	Tunnels	0	0.00
	Subtotal		66.50
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	5	26.40
	Runways	7	211.00
	Subtotal		237.50
		Total	912.40

Table 3: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	37.70
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		37.70
Waste Water	Distribution Lines	NA	22.60
	Facilities	2	129.20
	Pipelines	0	0.00
	Subtotal		151.80
Natural Gas	Distribution Lines	NA	15.10
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		15.10
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	2	0.20
	Subtotal		0.20
	Total		204.80

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Cannibal M7.0 CEUS Event
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-107.16
Latitude of Epicenter	37.94
Earthquake Magnitude	7.00
Depth (Km)	10.00
Rupture Length (Km)	42.66
Rupture Orientation (degrees)	160.00
Attenuation Function	CEUS Event

Building Damage

Building Damage

HAZUS estimates that about 629 buildings will be at least moderately damaged. This is over 13.00 % of the total number of buildings in the region. There are an estimated 12 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	3	0.09	1	0.08	0	0.09	0	0.10	0	0.08
Commercial	19	0.58	6	0.70	5	0.98	1	1.13	0	1.19
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	1	0.04	0	0.05	0	0.06	0	0.06	0	0.05
Industrial	1	0.04	0	0.04	0	0.06	0	0.07	0	0.06
Other Residential	400	12.20	205	25.88	232	47.09	60	48.32	7	53.60
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	2,855	87.06	581	73.26	254	51.71	63	50.32	6	45.02
Total	3,280		793		492		125		12	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	2,284	69.64	467	58.92	127	25.88	13	10.63	1	6.59
Steel	7	0.20	2	0.25	2	0.45	1	0.51	0	0.73
Concrete	6	0.19	2	0.26	2	0.36	0	0.39	0	0.34
Precast	4	0.12	1	0.12	1	0.24	1	0.41	0	0.27
RM	547	16.67	98	12.39	112	22.69	43	34.31	2	19.04
URM	63	1.92	24	3.02	20	4.00	8	6.21	3	20.33
MH	369	11.26	198	25.02	228	46.37	59	47.55	7	52.71
Total	3,280		793		492		125		12	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 6: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	9	0	0	9
EOCs	0	0	0	0
PoliceStations	4	0	0	3
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	20	0	0	20	20
	Bridges	70	0	0	70	70
	Tunnels	0	0	0	0	0
Railways	Segments	57	0	0	57	57
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	5	0	0	5	5
	Runways	7	0	0	7	7

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	2	0	0	1	2
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	2	0	0	2	2

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	1,885	25	6
Waste Water	1,131	20	5
Natural Gas	754	21	5
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	4,701	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 1 ignitions that will burn about 0.02 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 7 people and burn about 0 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 18 households to be displaced due to the earthquake. Of these, 5 people (out of a total population of 12,413) will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	4	1	0	0
	Single Family	6	1	0	0
	Total	10	2	0	0
2 PM	Commercial	4	1	0	0
	Commuting	0	0	0	0
	Educational	2	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	1	0	0	0
	Single Family	1	0	0	0
	Total	8	1	0	0
5 PM	Commercial	3	1	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	2	0	0	0
	Single Family	2	0	0	0
	Total	7	1	0	0

Economic Loss

The total economic loss estimated for the earthquake is 36.60 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 21.08 (millions of dollars); 12 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 77 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.13	0.49	0.01	0.02	0.66
	Capital-Related	0.00	0.05	0.44	0.01	0.01	0.51
	Rental	0.48	0.39	0.33	0.00	0.01	1.21
	Relocation	0.05	0.01	0.02	0.00	0.00	0.08
	Subtotal	0.53	0.58	1.28	0.02	0.04	2.46
Capital Stock Losses							
	Structural	2.17	0.78	0.72	0.06	0.19	3.92
	Non_Structural	6.95	2.45	1.27	0.14	0.20	11.01
	Content	2.28	0.50	0.62	0.09	0.12	3.62
	Inventory	0.00	0.00	0.04	0.02	0.01	0.07
	Subtotal	11.41	3.73	2.65	0.30	0.53	18.62
	Total	11.94	4.31	3.93	0.32	0.58	21.08

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	583.58	\$0.00	0.00
	Bridges	24.91	\$0.36	1.43
	Tunnels	0.00	\$0.00	0.00
	Subtotal	608.50	0.40	
Railways	Segments	66.47	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	66.50	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	26.43	\$4.33	16.40
	Runways	211.03	\$0.00	0.00
	Subtotal	237.50	4.30	
	Total	912.40	4.70	

Table 14: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Line	37.70	\$0.11	0.30
	Subtotal	37.69	\$0.11	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	129.20	\$10.52	8.14
	Distribution Line	22.60	\$0.09	0.40
	Subtotal	151.82	\$10.61	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Line	15.10	\$0.10	0.64
	Subtotal	15.08	\$0.10	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.20	\$0.01	3.92
	Subtotal	0.19	\$0.01	
	Total	204.78	\$10.82	

Table 15. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of \$)

	LOSS	Total	%
First Year			
	Employment Impact	0	0.00
	Income Impact	0	-0.22
Second Year			
	Employment Impact	0	0.00
	Income Impact	(1)	-0.67
Third Year			
	Employment Impact	0	0.00
	Income Impact	(1)	-0.86
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(1)	-0.86
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(1)	-0.86
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(1)	-0.86

Appendix A: County Listing for the Region

Rio Grande,CO

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Colorado	Rio Grande	12,413	580	85	666
Total State		12,413	580	85	666
Total Region		12,413	580	85	666

HAZUS-MH: Earthquake Event Report



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Earthquake Scenario: *N Sangre M7.5 CEUS Event*

Print Date: *January 31, 2006*

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Building and Lifeline Inventory

Building Inventory

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Transportation and Utility Lifeline Inventory

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	Segments	20	583.60
	Tunnels	0	0.00
	Subtotal		608.50
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	57	66.50
	Tunnels	0	0.00
	Subtotal		66.50
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	5	26.40
	Runways	7	211.00
	Subtotal		237.50
		Total	912.40

Table 3: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	37.70
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		37.70
Waste Water	Distribution Lines	NA	22.60
	Facilities	2	129.20
	Pipelines	0	0.00
	Subtotal		151.80
Natural Gas	Distribution Lines	NA	15.10
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		15.10
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	2	0.20
	Subtotal		0.20
	Total		204.80

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	N Sangre M7.5 CEUS Event
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-105.63
Latitude of Epicenter	37.90
Earthquake Magnitude	7.50
Depth (Km)	10.00
Rupture Length (Km)	100.00
Rupture Orientation (degrees)	161.00
Attenuation Function	CEUS Event

Building Damage

Building Damage

HAZUS estimates that about 1,690 buildings will be at least moderately damaged. This is over 36.00 % of the total number of buildings in the region. There are an estimated 242 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	1	0.05	1	0.07	1	0.10	1	0.16	1	0.23
Commercial	5	0.25	4	0.39	9	1.00	8	1.48	5	2.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.01	0	0.02	1	0.07	1	0.12	0	0.16
Industrial	0	0.01	0	0.02	1	0.06	1	0.12	0	0.18
Other Residential	101	5.14	131	12.60	269	30.18	264	47.62	138	56.72
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	1,862	94.54	906	86.90	612	68.60	280	50.50	99	40.71
Total	1,969		1,042		892		555		243	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1,617	82.09	808	77.49	393	44.08	68	12.31	7	2.68
Steel	1	0.06	1	0.09	3	0.32	4	0.65	3	1.20
Concrete	1	0.06	1	0.12	3	0.35	3	0.58	2	0.76
Precast	1	0.03	1	0.05	2	0.18	2	0.41	2	0.65
RM	235	11.96	93	8.97	204	22.86	196	35.22	73	30.17
URM	27	1.36	18	1.76	27	3.02	23	4.14	22	9.02
MH	88	4.45	120	11.51	260	29.18	259	46.69	135	55.52
Total	1,969		1,042		892		555		243	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 6: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	9	0	0	0
EOCs	0	0	0	0
PoliceStations	4	0	0	1
FireStations	2	0	0	0

Transportation and Utility Lifeline Damage

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	20	0	0	20	20
	Bridges	70	7	0	63	70
	Tunnels	0	0	0	0	0
Railways	Segments	57	0	0	57	57
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	5	0	0	5	5
	Runways	7	0	0	7	7

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	2	0	0	1	2
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	2	0	0	2	2

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	1,885	88	22
Waste Water	1,131	70	17
Natural Gas	754	75	19
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	4,701	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 1 ignitions that will burn about 0.02 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 7 people and burn about 0 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 213 households to be displaced due to the earthquake. Of these, 62 people (out of a total population of 12,413) will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	2	0	0	0
	Industrial	0	0	0	0
	Other-Residential	33	8	1	1
	Single Family	42	11	2	3
	Total	78	20	3	5
2 PM	Commercial	37	11	2	4
	Commuting	0	0	0	0
	Educational	17	5	1	2
	Hotels	0	0	0	0
	Industrial	3	1	0	0
	Other-Residential	7	2	0	0
	Single Family	9	2	0	1
	Total	73	21	3	7
5 PM	Commercial	34	10	2	3
	Commuting	1	1	1	0
	Educational	1	0	0	0
	Hotels	1	0	0	0
	Industrial	2	1	0	0
	Other-Residential	12	3	0	1
	Single Family	16	4	1	1
	Total	66	19	4	6

Economic Loss

The total economic loss estimated for the earthquake is 124.26 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 103.82 (millions of dollars); 13 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 67 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.74	2.94	0.08	0.15	3.91
	Capital-Related	0.00	0.32	2.44	0.05	0.06	2.86
	Rental	2.00	2.03	1.69	0.03	0.10	5.85
	Relocation	0.21	0.05	0.09	0.00	0.02	0.37
	Subtotal	2.21	3.14	7.16	0.16	0.33	13.00
Capital Stock Losses							
	Structural	9.35	4.12	4.76	0.46	1.46	20.15
	Non_Structural	27.30	14.25	9.98	1.41	1.71	54.64
	Content	6.60	2.72	4.28	0.87	0.93	15.41
	Inventory	0.00	0.00	0.28	0.22	0.13	0.62
	Subtotal	43.25	21.09	19.30	2.96	4.23	90.82
	Total	45.46	24.23	26.46	3.12	4.56	103.82

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	583.58	\$0.00	0.00
	Bridges	24.91	\$1.71	6.87
	Tunnels	0.00	\$0.00	0.00
	Subtotal	608.50	1.70	
Railways	Segments	66.47	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	66.50	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	26.43	\$6.09	23.06
	Runways	211.03	\$0.00	0.00
	Subtotal	237.50	6.10	
	Total	912.40	7.80	

Table 14: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Line	37.70	\$0.40	1.05
	Subtotal	37.69	\$0.40	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	129.20	\$11.55	8.94
	Distribution Line	22.60	\$0.31	1.39
	Subtotal	151.82	\$11.86	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Line	15.10	\$0.34	2.23
	Subtotal	15.08	\$0.34	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.20	\$0.03	13.92
	Subtotal	0.19	\$0.03	
	Total	204.78	\$12.63	

Table 15. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of \$)

	LOSS	Total	%
First Year			
	Employment Impact	0	0.00
	Income Impact	(1)	-1.11
Second Year			
	Employment Impact	0	0.00
	Income Impact	(3)	-3.36
Third Year			
	Employment Impact	0	0.00
	Income Impact	(4)	-4.32
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(4)	-4.32
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(4)	-4.32
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(4)	-4.32

Appendix A: County Listing for the Region

Rio Grande,CO

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Colorado	Rio Grande	12,413	580	85	666
Total State		12,413	580	85	666
Total Region		12,413	580	85	666

HAZUS-MH: Earthquake Event Report



Region Name: *Rio Grande County*

Earthquake Scenario: *N Sangre M7.5 WUS-Extensional*

Print Date: *January 31, 2006*

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Colorado

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 911.45 square miles and contains 4 census tracts. There are over 4 thousand households in the region and has a total population of 12,413 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 666 (millions of dollars). Approximately 99.00 % of the buildings (and 87.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 912 and 129 (millions of dollars), respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 4 thousand buildings in the region which have an aggregate total replacement value of 666 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 62% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 9 schools, 2 fire stations, 4 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 4 dams identified within the region. Of these, 1 of the dams are classified as 'high hazard'. The inventory also includes 3 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 1,041.00 (millions of dollars). This inventory includes over 138 kilometers of highways, 70 bridges, 3,769 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	70	24.90
	Segments	20	583.60
	Tunnels	0	0.00
	Subtotal		608.50
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	57	66.50
	Tunnels	0	0.00
	Subtotal		66.50
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	5	26.40
	Runways	7	211.00
	Subtotal		237.50
		Total	912.40

Table 3: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	37.70
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		37.70
Waste Water	Distribution Lines	NA	22.60
	Facilities	2	129.20
	Pipelines	0	0.00
	Subtotal		151.80
Natural Gas	Distribution Lines	NA	15.10
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		15.10
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	2	0.20
	Subtotal		0.20
	Total		204.80

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	N Sangre M7.5 WUS-Extensional
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-105.63
Latitude of Epicenter	37.90
Earthquake Magnitude	7.50
Depth (Km)	10.00
Rupture Length (Km)	100.00
Rupture Orientation (degrees)	161.00
Attenuation Function	WUS Shallow Crustal Event - Extensional

Building Damage

Building Damage

HAZUS estimates that about 434 buildings will be at least moderately damaged. This is over 9.00 % of the total number of buildings in the region. There are an estimated 25 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	3	0.07	1	0.12	1	0.18	0	0.16	0	0.14
Commercial	22	0.56	4	1.01	4	1.29	1	1.06	0	1.02
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	1	0.03	0	0.08	0	0.12	0	0.11	0	0.11
Industrial	1	0.03	0	0.08	0	0.14	0	0.13	0	0.15
Other Residential	448	11.60	133	32.69	193	67.24	106	86.08	24	96.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	3,385	87.71	269	66.02	89	31.03	15	12.47	1	2.57
Total	3,860		408		286		123		25	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	2,655	68.79	201	49.31	34	11.91	2	1.82	0	0.16
Steel	5	0.12	2	0.40	3	1.06	2	1.33	0	1.79
Concrete	7	0.18	2	0.44	1	0.50	0	0.29	0	0.15
Precast	4	0.12	1	0.20	1	0.32	0	0.28	0	0.10
RM	688	17.82	57	13.92	46	16.16	11	8.66	0	0.51
URM	86	2.23	17	4.18	11	3.70	3	2.29	1	2.01
MH	414	10.73	129	31.54	190	66.35	105	85.32	24	95.28
Total	3,860		408		286		123		25	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 6: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	9	0	0	9
EOCs	0	0	0	0
PoliceStations	4	0	0	4
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Number of Locations_				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	20	0	0	20	20
	Bridges	70	0	0	70	70
	Tunnels	0	0	0	0	0
Railways	Segments	57	0	0	57	57
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	5	0	0	5	5
	Runways	7	0	0	7	7

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	2	0	0	2	2
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	2	0	0	2	2

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	1,885	28	7
Waste Water	1,131	22	5
Natural Gas	754	23	6
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	4,701	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 13 households to be displaced due to the earthquake. Of these, 4 people (out of a total population of 12,413) will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	7	1	0	0
	Single Family	2	0	0	0
	Total	8	1	0	0
2 PM	Commercial	3	1	0	0
	Commuting	0	0	0	0
	Educational	2	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	1	0	0	0
	Single Family	0	0	0	0
	Total	6	1	0	0
5 PM	Commercial	2	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	2	0	0	0
	Single Family	1	0	0	0
	Total	6	1	0	0

Economic Loss

The total economic loss estimated for the earthquake is 16.28 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 11.98 (millions of dollars); 15 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 65 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.09	0.44	0.02	0.03	0.57
	Capital-Related	0.00	0.04	0.37	0.01	0.01	0.43
	Rental	0.14	0.34	0.26	0.01	0.02	0.77
	Relocation	0.01	0.01	0.02	0.00	0.00	0.05
	Subtotal	0.16	0.48	1.09	0.03	0.05	1.81
Capital Stock Losses							
	Structural	0.67	0.97	0.61	0.08	0.25	2.58
	Non_Structural	2.04	2.51	0.98	0.17	0.20	5.90
	Content	0.64	0.38	0.41	0.10	0.10	1.63
	Inventory	0.00	0.00	0.02	0.03	0.01	0.06
	Subtotal	3.35	3.86	2.03	0.38	0.56	10.17
	Total	3.51	4.33	3.12	0.41	0.61	11.98

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	583.58	\$0.00	0.00
	Bridges	24.91	\$0.43	1.72
	Tunnels	0.00	\$0.00	0.00
	Subtotal	608.50	0.40	
Railways	Segments	66.47	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	66.50	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	26.43	\$1.88	7.13
	Runways	211.03	\$0.00	0.00
	Subtotal	237.50	1.90	
	Total	912.40	2.30	

Table 14: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Line	37.70	\$0.13	0.33
	Subtotal	37.69	\$0.13	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	129.20	\$1.66	1.28
	Distribution Line	22.60	\$0.10	0.44
	Subtotal	151.82	\$1.76	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Line	15.10	\$0.11	0.70
	Subtotal	15.08	\$0.11	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.20	\$0.00	2.27
	Subtotal	0.19	\$0.00	
	Total	204.78	\$1.99	

Table 15. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of \$)

	LOSS	Total	%
First Year			
	Employment Impact	0	0.00
	Income Impact	0	-0.13
Second Year			
	Employment Impact	0	0.00
	Income Impact	0	-0.38
Third Year			
	Employment Impact	0	0.00
	Income Impact	0	-0.49
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	0	-0.49
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	0	-0.49
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	0	-0.49

Appendix A: County Listing for the Region

Rio Grande,CO

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Colorado	Rio Grande	12,413	580	85	666
Total State		12,413	580	85	666
Total Region		12,413	580	85	666

HAZUS-MH: Earthquake Event Report



Region Name: *Rio Grande County*

Earthquake Scenario: *Rio Grande County Random EQ WUS*

Print Date: *February 10, 2006*

Disclaimer:

The estimates of social and economic impacts contained in this report were produced using HAZUS loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

HAZUS is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of HAZUS is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Colorado

Note:

Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 911.45 square miles and contains 4 census tracts. There are over 4 thousand households in the region and has a total population of 12,413 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 4 thousand buildings in the region with a total building replacement value (excluding contents) of 666 (millions of dollars). Approximately 99.00 % of the buildings (and 87.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 912 and 129 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

HAZUS estimates that there are 4 thousand buildings in the region which have an aggregate total replacement value of 666 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 62% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

HAZUS breaks critical facilities into two (2) groups: essential facilities and high potential loss (HPL) facilities. Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 9 schools, 2 fire stations, 4 police stations and 0 emergency operation facilities. With respect to HPL facilities, there are 4 dams identified within the region. Of these, 1 of the dams are classified as 'high hazard'. The inventory also includes 3 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within HAZUS, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 2 and 3.

The total value of the lifeline inventory is over 1,041.00 (millions of dollars). This inventory includes over 138 kilometers of highways, 70 bridges, 3,769 kilometers of pipes.

Table 2: Transportation System Lifeline Inventory

System	Component	# locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	70	24.90
	Segments	20	583.60
	Tunnels	0	0.00
	Subtotal		608.50
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	57	66.50
	Tunnels	0	0.00
	Subtotal		66.50
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		0.00
Bus	Facilities	0	0.00
	Subtotal		0.00
Ferry	Facilities	0	0.00
	Subtotal		0.00
Port	Facilities	0	0.00
	Subtotal		0.00
Airport	Facilities	5	26.40
	Runways	7	211.00
	Subtotal		237.50
		Total	912.40

Table 3: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	37.70
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		37.70
Waste Water	Distribution Lines	NA	22.60
	Facilities	2	129.20
	Pipelines	0	0.00
	Subtotal		151.80
Natural Gas	Distribution Lines	NA	15.10
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		15.10
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		0.00
Electrical Power	Facilities	0	0.00
	Subtotal		0.00
Communication	Facilities	2	0.20
	Subtotal		0.20
	Total		204.80

Earthquake Scenario

HAZUS uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Rio Grande County Random EQ WUS
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-106.39
Latitude of Epicenter	37.59
Earthquake Magnitude	6.50
Depth (Km)	10.00
Rupture Length (Km)	18.20
Rupture Orientation (degrees)	150.00
Attenuation Function	WUS Shallow Crustal Event - Extensional

Building Damage

Building Damage

HAZUS estimates that about 1,556 buildings will be at least moderately damaged. This is over 33.00 % of the total number of buildings in the region. There are an estimated 170 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the HAZUS technical manual. Table 4 below summaries the expected damage by general occupancy for the buildings in the region. Table 5 summaries the expected damage by general building type.

Table 4: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	2	0.09	1	0.07	1	0.09	0	0.10	0	0.05
Commercial	9	0.46	6	0.53	9	0.95	5	1.16	2	0.98
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	1	0.03	0	0.04	1	0.06	0	0.06	0	0.03
Industrial	1	0.03	0	0.03	1	0.06	0	0.07	0	0.03
Other Residential	161	7.99	173	15.32	295	31.24	182	41.37	92	54.06
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	1,841	91.40	950	84.01	639	67.59	252	57.24	76	44.85
Total	2,014		1,131		946		441		170	

Table 5: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	1,570	77.93	827	73.09	407	43.07	79	17.89	10	5.79
Steel	3	0.17	2	0.18	4	0.38	2	0.42	1	0.46
Concrete	3	0.15	2	0.19	3	0.33	2	0.39	1	0.39
Precast	2	0.08	1	0.09	2	0.20	2	0.35	0	0.25
RM	269	13.37	112	9.88	211	22.32	158	35.75	52	30.67
URM	28	1.39	24	2.09	30	3.17	20	4.50	16	9.12
MH	139	6.92	164	14.48	289	30.52	179	40.70	91	53.31
Total	2,014		1,131		946		441		170	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 6: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	0	0	0	0
Schools	9	0	0	9
EOCs	0	0	0	0
PoliceStations	4	0	0	1
FireStations	2	0	0	1

Transportation and Utility Lifeline Damage

Table 7 provides damage estimates for the transportation system.

Table 7: Expected Damage to the Transportation Systems

System	Component	Locations/ Segments	Number of Locations_			
			With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	20	0	0	20	20
	Bridges	70	2	0	68	69
	Tunnels	0	0	0	0	0
Railways	Segments	57	0	0	57	57
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	5	0	0	5	5
	Runways	7	0	0	7	7

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 8-10 provide information on the damage to the utility lifeline systems. Table 8 provides damage to the utility system facilities. Table 9 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, HAZUS performs a simplified system performance analysis. Table 10 provides a summary of the system performance information.

Table 8 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	2	0	0	2	2
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	2	0	0	2	2

Table 9 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	1,885	122	31
Waste Water	1,131	97	24
Natural Gas	754	104	26
Oil	0	0	0

Table 10: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	4,701	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. HAZUS uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 1 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

HAZUS estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

HAZUS estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 145 households to be displaced due to the earthquake. Of these, 41 people (out of a total population of 12,413) will seek temporary shelter in public shelters.

Casualties

HAZUS estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 11 provides a summary of the casualties estimated for this earthquake

Table 11: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	1	0	0	0
	Industrial	0	0	0	0
	Other-Residential	21	5	0	1
	Single Family	31	8	1	2
	Total	54	13	2	3
2 PM	Commercial	22	6	1	2
	Commuting	0	0	0	0
	Educational	10	3	1	1
	Hotels	0	0	0	0
	Industrial	2	0	0	0
	Other-Residential	4	1	0	0
	Single Family	7	2	0	1
	Total	45	12	2	4
5 PM	Commercial	20	6	1	2
	Commuting	0	1	1	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	1	0	0	0
	Other-Residential	8	2	0	0
	Single Family	12	3	0	1
	Total	42	12	3	3

Economic Loss

The total economic loss estimated for the earthquake is 88.75 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 75.56 (millions of dollars); 11 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 77 % of the total loss. Table 12 below provides a summary of the losses associated with the building damage.

Table 12: Building-Related Economic Loss Estimates
(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.49	1.67	0.04	0.07	2.27
	Capital-Related	0.00	0.21	1.49	0.02	0.02	1.74
	Rental	1.81	1.32	1.04	0.01	0.04	4.23
	Relocation	0.19	0.04	0.06	0.00	0.01	0.29
	Subtotal	2.00	2.06	4.26	0.07	0.15	8.54
Capital Stock Losses							
	Structural	8.33	2.73	2.61	0.18	0.62	14.47
	Non_Structural	25.38	9.24	5.18	0.44	0.70	40.94
	Content	6.61	1.84	2.28	0.26	0.38	11.37
	Inventory	0.00	0.00	0.14	0.07	0.04	0.25
	Subtotal	40.31	13.81	10.20	0.95	1.75	67.03
	Total	42.31	15.87	14.46	1.02	1.90	75.56

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, HAZUS computes the direct repair cost for each component only. There are no losses computed by HAZUS for business interruption due to lifeline outages. Tables 13 & 14 provide a detailed breakdown in the expected lifeline losses.

HAZUS estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 15 presents the results of the region for the given earthquake.

Table 13: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	583.58	\$0.00	0.00
	Bridges	24.91	\$1.31	5.26
	Tunnels	0.00	\$0.00	0.00
	Subtotal	608.50	1.30	
Railways	Segments	66.47	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	66.50	0.00	
Light Rail	Segments	0.00	\$0.00	0.00
	Bridges	0.00	\$0.00	0.00
	Tunnels	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Bus	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Ferry	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Port	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	0.00	
Airport	Facilities	26.43	\$5.09	19.25
	Runways	211.03	\$0.00	0.00
	Subtotal	237.50	5.10	
	Total	912.40	6.40	

Table 14: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Line	37.70	\$0.55	1.46
	Subtotal	37.69	\$0.55	
Waste Water	Pipelines	0.00	\$0.00	0.00
	Facilities	129.20	\$5.32	4.12
	Distribution Line	22.60	\$0.44	1.93
	Subtotal	151.82	\$5.76	
Natural Gas	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Distribution Line	15.10	\$0.47	3.09
	Subtotal	15.08	\$0.47	
Oil Systems	Pipelines	0.00	\$0.00	0.00
	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Electrical Power	Facilities	0.00	\$0.00	0.00
	Subtotal	0.00	\$0.00	
Communication	Facilities	0.20	\$0.01	7.11
	Subtotal	0.19	\$0.01	
	Total	204.78	\$6.79	

Table 15. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of \$)

	LOSS	Total	%
First Year			
	Employment Impact	0	0.00
	Income Impact	(1)	-0.82
Second Year			
	Employment Impact	0	0.00
	Income Impact	(2)	-2.49
Third Year			
	Employment Impact	0	0.00
	Income Impact	(3)	-3.20
Fourth Year			
	Employment Impact	0	0.00
	Income Impact	(3)	-3.20
Fifth Year			
	Employment Impact	0	0.00
	Income Impact	(3)	-3.20
Years 6 to 15			
	Employment Impact	0	0.00
	Income Impact	(3)	-3.20

Appendix A: County Listing for the Region

Rio Grande,CO

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Colorado	Rio Grande	12,413	580	85	666
Total State		12,413	580	85	666
Total Region		12,413	580	85	666