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6.19 Transport

Impacts relating to traffic associated with the Amulsar Project include direct increase in traffic on the local road network, potentially affecting journeys, junction capacity and safety. The Project is, however, served by Magisterial and Republic roads, the M-2 and H-42 respectively, that provide direct access from existing access junctions to the proposed mine and associated infrastructure areas. The Project has, therefore, direct access to the strategic road network. Other potential impacts include increased wear and tear of road surfaces as a consequence of increased HGV traffic to and from the Project and a potential increase in environmental impacts such as an increase in noise levels and a decrease in air quality resulting from increased traffic on the highway network.

The main access junctions to the Project include (see Figure 4.18.3):

- Approximately 1.3km south of the turn-off to Gndevaz on the H-42 highway is an existing junction with an unmade agricultural track leading to the east. The track and junction will be upgraded as the main site access to the HLF, ADR plant and ancillary operations. This junction (Access A) will be required during the construction, operation and closure phase of the Project. Employees who work within the HLF will use this junction as their main work access.
- North of Gndevaz turn-off on the H-42 highway is an existing junction with an old tarred road leading to Saravan that will connect with the lower section of the conveyor, other infrastructure in the area, and the main mine access road (when constructed). This access road and junction (Access B) will be upgraded and used by staff and for deliveries accessing the main mine operational area.
- To the north of Access A, a secondary junction (Access C) will provide access from the H-42 to the east of the HLF for light vehicles only.
- North of Kechut on the H-42 highway is an existing junction onto a gravel track to the east of the H-42, which is currently used to gain access to the site exploration camp. This is also the access to Kechut landfill, which is approximately 0.5km off the H-42. This junction (Access D) will be the initial route to the mine facilities at the top of the mountain during the construction phase only, until the main road from Access B has been constructed.

6.19.1 Impact Prediction Methodology

Introduction

TIA methodology conforms to current good practice and in the absence of appropriate standards for Armenia, traffic impacts are assessed in line with the following published UK guidance, (which to a large extent harmonises with that of the EU):

- Institute of Environmental Management and Assessment (IEMA) Guidelines for the Environmental Assessment of Road Traffic (1991);
- Institution of Highway and Transportation (IHT) Guidelines for Traffic Impact Assessment (1994); and
- Department for Transport (DfT) Guidance on Transport Assessments (2007).

In taking account of this guidance, the methodology has been specifically tailored to address the requirements of the Amulsar Project and ESIA methodology (Section 6.1-6.3).

Summary of the Impact Assessment Process

The technical approach for the assessment of traffic impact associated with the Amulsar Project has the following stages:

- Establishment of baseline conditions;
- Characterisation of the transportation aspects of the Project;
- Assessment of the effects of the construction phase;
- Identification of mitigation measures for construction impacts;
- Assessment of the effects of the operational phase;
- Identification of mitigation measures for the operational phase;
- Identification of the effects of the closure phase (quantitative, as these are significantly less than the construction and operational phase); and
- Identification of residual impacts for the Project and their significance in relation to pre-determined criteria.

More detailed aspects of the methodology are discussed in the following sections.

6.19.2 Methodology for Evaluating Traffic Impact

Baseline conditions have been established using a combination of sources including secondary and primary sources of data (see Chapter 4.17). The methodology used for this assessment has been outlined in the following paragraphs and in Table 6.19.1 and has been based on that set out in Sections 6.1 to 6.3.

Direction

The direction of potential impacts takes account of existing road infrastructure and baseline conditions. In terms of the highway network, a project that delivers improvements to the current road infrastructure can be positive in terms of improving connectivity between affected communities and access to the strategic road networks. Negative impacts relate to whether the existing infrastructure can accommodate an increase in traffic associated with project phase(s).

Magnitude

The use of the highway link capacity assessments conforms to advice within the IEMA Guidelines for the environmental assessment of road traffic and is a standard tool for assessing traffic impacts for ESIA required for development projects. Link capacity assessment has been used in this instance, because the marginal changes in traffic on the perceptible environment are less sensitive than changes in traffic flows at junctions in the surrounding network. This allows for a more direct assessment of changes in traffic levels which might be deemed significant in environmental terms.

For key highway links, a baseline case in terms of link capacity has first been established which accords with the standards set out within the UK's Design Manual for Roads and Bridges Volume 5, Section 1, Part 3, TA 46/97 (DMRB). The highway links assessment has been based on the key site access points. (See Figure 4.18.3)

The magnitude of direct physical impacts, with respect to traffic, is determined by the analysis of the base flows on the road network and assessing these against the predicted Project traffic at peak hours.

Geographic Extent

The traffic impact assessment is primarily focussed on local and regional areas of influence. The access roads to the Project are in the proximity of Gndevaz (Access B immediately east of the town and Accesses A and C to the south) and Kechut (Access D). Figure 4.18.3 shows that the site access junctions are directly off the H-42 and that Project traffic (including HGVs) will not pass directly through the local communities (unless the traffic originates in the communities, e.g. staff or supplies) because the H-42 by-passes the communities of Gndevaz and Kechut. Employment-related traffic is predicted to increase from each of the communities and has therefore been considered for each Phase of the Project.

Duration

The IEMA guidance suggests undertaking separate assessments when significant phases of a development will have differing natures and effects, or where there are likely to be notable levels of construction traffic. Consequently, changes to the highway link capacity of surrounding roads and for relevant road junctions have been assessed for both the 'construction' and 'operational' phases of the Project. These have then been compared to baseline conditions to assess potential impacts and derive the significance of the effects. The closure phase has been considered qualitatively, as the predicted traffic flows are significantly less than the earlier phases of the Project.

The IEMA guidelines indicate that assessment of the traffic impact for construction phases should be based on the period where construction traffic activities are at the greatest intensity. The guidance also indicates that assessment of the completed development should be undertaken relative to the first full year of completion rather than for any period extending into the future. This is because the year of opening represents the period where environmental change resulting from the development traffic will be at its greatest relative to the general growth in background traffic.

The construction and operational phases are therefore considered separately because of their different nature and effects. Traffic impacts associated with each phase have been set out quantitatively where information is available. However, in many instances, gaps in the Project information have required assumptions to be made, based on experiences with TIAs of similar projects. Individual Project activities with associated traffic implications have been categorised and, where possible, quantified for the purpose of assessment.

Significance Criteria

A critical feature of an assessment of traffic impacts is determining whether a given impact is significant. Having identified the magnitude of the impact there are various ways of interpreting whether or not this is considered significant.

Two broad principles outlined within the IEMA guidelines advise on the screening process to limit the scale and extent of the assessment. These are to:

- "Include highways links where traffic flows will increase by more than 30% (or the number of heavy goods vehicles will increase by more than 30%); and
- "Include any other specific sensitive areas where traffic flows will increase by 10% or more."

In considering thresholds for significance, it is important to recognise the difference between variations in traffic activity that constitute a highway impact, for example congestion or delay at junctions, and those that would constitute an environmental impact.

A key characteristic for this assessment is that for many effects there are no simple rules or formulae which define thresholds of significance within an environmental impact assessment. Whether an impact is considered significant will depend on the level of development traffic activity, the level of traffic already on the surrounding network, the level of traffic congestion in the area and the environmental setting within which the Project and its associated traffic is located. There is therefore, a need for interpretation and judgement, qualified by appropriate data, secondary information and expert opinion.

The methodology to make judgements has been developed with due cognisance to the thresholds set out in the IEMA guidance. Table 6.19.1 provides a summary of the attributes that have been considered in order to assess significance.

Table 6.19.1: Classification of Transport Impacts

Criteria	Scale	General definition	Application to transport assessment for the Project
Direction	Positive	Impact provides a net benefit to the affected person(s).	Improvements in road infrastructure, public transport and reduction in traffic generation in communities
	Negative	Impact results in a net loss to the affected persons(s).	Reduction in public transport, increase in traffic and congestion at road junctions, increase in risk of accident and reduction in road safety.
	Mixed	Impact may be positive or negative, but requires an intervention to demonstrate net benefit.	Combinations of the examples given above
	Neutral	No net benefit or loss to the affect person(s).	No net change in traffic, or the change would not be significant given the nature of the M-2 & H-42 roads
Magnitude	Negligible	No noticeable change anticipated.	No net change in traffic; or the change would not be significant given the nature of the M-2 & H-42 roads.
	Low	Result predicted to be different from baseline conditions, but not to impair or change quality of life of the affected person(s).	Small change in capacity of junctions. Transport flow limited to major roads, with minimal or no change in roads serving communities and residential properties.
	Moderate	Result predicted to impair or benefit quality of life of the affected persons(s).	Noticeable change to capacity of junction to accept additional traffic. Wear to road surface sufficient to affect other road

Table 6.19.1: Classification of Transport Impacts			
Criteria	**Scale**	**General definition**	**Application to transport assessment for the Project**
			users. Increase in volume of traffic through communities or near residential properties.
	High	Result predicted to seriously impair or substantially improve quality of life.	Inability of junctions to cope with level of traffic generated, resulting in driver delay and reduced safety. Major wear of road surfaces to cause a reduction in safety of the road for other users. Congestion and heavy goods traffic through communities or near residential properties.
Geographic Extent	Individual	Confined to individuals or individual households	Traffic generation is restricted to main or strategic highways, no properties impacted.
	Local	Confined to the local area of influence.	Traffic generation is restricted to main or strategic highways, no communities impacted.
	Regional	Confined to the regional area of influence.	Traffic generation extends to communities on the highway network
	National	Extends to national level.	Traffic generation such that impacted communities extend to a national level.
	Trans-boundary	Results impact neighbouring countries in the region.	Traffic generation affects impacts trans-boundary routes.
Duration	Short-term	Construction and prior to operations.	Includes: employees, deliveries of construction material, plant and equipment and other services
	Medium-term	Operations	Includes: employees, deliveries of material and export of products, services and repairs
	Long-term	Through decommissioning and closure.	Includes: employees, deliveries of material, export of redundant plant and equipment.

6.19.3 Description of Predicted Traffic Generation

Highway Links

Construction Phase

Traffic volumes on the M-2 and H-42 main roads will increase during construction due to the following (see Figure 4.18.3 for the location of the access junctions):

- Transport of construction materials, mine equipment and fleet vehicles, potentially sourced internationally from the ports of Poti or Batumi in Georgia, and then transported through Armenia, which will be transported by road from Yerevan on the M-2 and be delivered to the Project on the H-42 to Junctions A and B. Light goods vehicles (LGVs) may also use Junctions C and D.

Traffic volumes on the local road network will also increase due to the increase in employment and provision of goods and services, including:

- Transport of construction workers to Junctions A and B, southbound on the H-42 from the worker accommodation camp and/or Jermuk, at shift changes;
- Transport of locally based construction workers from other surrounding communities, travelling to and from Junction A at shift changes;
- Local supplies that are sourced from Jermuk, Kechut and Gndevaz, via the H-42 to the site access, or from Saralanj, Saravan and Gorayk via the M-2 and H-42 to Access A, B and D; and
- Supplies that are sourced from greater distances, but within Armenia that will access the Project via the M-2 and H-42.

Operational Phase

Heavy goods traffic volumes on the M-2 to H-42 main roads will increase during operations, in comparison to the baseline conditions, due to:

- Transport of bulk material within Armenia, including spares, plant and equipment required to support and maintain mining operations;
- Transport of materials sourced internationally and delivered via the ports of Poti and Batumi in Georgia, or through Yerevan International Airport and then transported through Armenia, travelling on the M-2 and H-42 to Project Junctions A and B; and
- Export of doré product, by armoured transport from Junction A approximately every 2 weeks.

Traffic volumes on the local road network will also increase due to the local employment and provision of goods and services required for the operation of the mine, including:

- Transport of employees from the Project employee accommodation in Jermuk to the mine (Access A & B);
- Local employees, who reside in surrounding communities, travelling to and from work at shift change (Access A & B);
- Local supplies that are sourced from Jermuk, Kechut and Gndevaz, via the H-42, or from Saralanj, Saravan and Gorayk via the M-2 and H-42 (Access A and B);
- Supplies that are sourced from greater distances, but within Armenia and will access the site via the M-2 and H-42 (Access A & B); and
- Transport of goods and services in LGVs required to maintain mining operations (Access A & B).

Mine Closure

Similar to operations, the junctions used by the Project will be A and B, onto the H-42. Light vehicle traffic will also make use of the access junction C (see Figure 4.18.3 for the location of junctions).

Traffic volumes on the M-2 to H-42 main roads will result from the following:

- Transport of unused materials and dismantled equipment that will remain within Armenia, expected to be transported on the H-42 to M-2 and then in the general direction of Yerevan;
- Transport of fuels and other supplies required for rehabilitation and closure activities and to be delivered to the Project on the M-2 to H-42; and
- Export of redundant plant and equipment for sale outside Armenia, travelling on the H-42 and M-2 from the Project to the ports of Poti and Batumi in Georgia.

Access roads will also be rehabilitated following mine closure.

Traffic volumes on the local road network will continue to be generated from continued (albeit much reduced) employment and to a lesser extent the provision of goods and services required for the mine post closure activities, including:

- Local employees, who reside in surrounding communities, travelling to and from work at shift changes; and
- Local supplies that are sourced from Jermuk, Kechut and Gndevaz, via the H-42 to access junctions A and B, or from Saralanj, Saravan and Gorayk via the M-2 and H-42 to the mine and HLF.

6.19.4 Impact Assessment

Traffic Generation during Construction

The estimated traffic generation of the construction period has been determined for two categories of traffic: construction workforce trips, and construction materials and equipment trips. To generate the workforce traffic estimates, the following assumptions were made:

- The majority of senior staff will reside in Jermuk and will travel by car to the Project site. These senior staff are assumed to be travelling by car to site and are likely to travel on the public highway on a daily basis;
- Construction workers will be transported directly to site each day by chartered shuttle bus using the H-42 (through Access A & B). Operations will be over two 12 hour shifts.

Table 6.19.2 summarises the estimated construction workforce trip generation at peak (see also Figure 3.25 that show the profile of work force numbers for the duration of the construction phase.

Table 6.19.2: Estimated Construction Workforce Trip Generation

Scenario	Mode	No. of workers	No. of vehicles	Total peak hour vehicle movements
At shift changeover assuming senior and construction staff arriving at the same hour	Chartered bus (Locally based construction staff)	690[2]	19[2]	38[2]
	Private vehicles (senior staff)	<30	30[1]	30[4]

Notes:
1 Assumes approximately 1 senior employee per car and maximum for each shift change over.
2 Assumes that the majority of staff that travel to the site are picked from local villages by bus with an average capacity of 35 persons. This also assumes that at peak periods there is the potential for the shuttle buses to travel on the H-42 from worker accommodation (either the camp and/or Jermuk) and access junction A or D.
3 Assumes that all chartered buses will enter and leave the site during the 1 hour peak period.
4 Assumes Senior staff will travel to the site and do not leave until the end of the shift.

HGV requirements for the construction have been determined based on assumptions taken from the Project Description (Chapter 3, section 3.15.4) (see Table 6.19.3):

- Concrete supplies (cement and sand) during construction: 2 trips per day.
- Structural steel: 1 trip per day.
- Fuel delivery: 1 fuel delivery, using an 8 tonne delivery truck, every 2 days.

- Miscellaneous modular buildings required for offices and contractor facilities: up to 10 deliveries at the onset of construction, with repeats during the construction period.
- Additional materials, including items such as piping, wiring, cables, rebar, cable tray and pipe supports: 4 trips per week or 1 trip per day.
- Transport of equipment including components for crushers, screens, mills, conveyor, ADR plant and various tanks and liner material: during peak time 15 trips per day.
- Abnormal or oversized loads: in excess of 1000 trips will be required in the construction period, with most travelling through the Port of Poti (Georgia) and overland by road through Armenia. These loads will therefore likely have to travel along the M-1 and M-2 highways passing through Yerevan. Assume 3 per day on average and up to 15 per day during peak periods.
- There is the potential for road transport of aggregates and construction fill for various requirements during construction that cannot be met by onsite quarries. A peak traffic generation of 36 trips per day has been assumed.
- Food and consumables would generate up to 2 deliveries per day, based on use of LGVs.
- There will also be a requirement for delivery of potable water during the early stages of the construction phase. Assume LGV service vehicles 2 per day.

It should be noted that the breakdown of construction materials across project components and activities has not been determined at this stage of Project planning and will be further developed during the detailed design phase. For the purpose of the transport assessment, the traffic generation assumes a worst case of all deliveries arriving within a peak hour, to assess the significance of the potential impact in the context of the road and existing users (see Table 6.19.3).

Table 6.19.3: Summary of Construction Materials and Equipment Trip Generation

Source	Light Vehicle (VPD)[1]	Heavy Vehicle (VPD)[1]	Daily Traffic Generation (VMPD)[2]
Construction Materials	0	37[3]	74
Waste Materials	0	1	2
Mine Equipment, and Fleet Vehicle and oversized vehicles	0	30	60
Service Vehicles	5	0	10
Total	5	68	146

Notes:
1 Vehicles per day
2 Vehicle movements per day
3 Total daily vehicle trips consists of an equal number of trips 'into' and 'out' of the site
Assumptions above would generate traffic 50:50 to Junctions A (or B) and D

Traffic Generation during Operations

To generate the operational workforce traffic estimates, the following estimates were derived (see Table 6.19.4):

- Operational workers will either be based in a hotel in Jermuk or based locally in the villages. All staff will therefore be arriving by car or chartered bus to the Project.
- Traffic generation at shift change will be through the Junctions A and B.
- 40 senior staff [30 on one dayshift and 10 nightshift], the majority of whom will reside in hotel accommodation at Jermuk, are assumed to travel by car to site.
- There will be two shifts and it is assumed that, at the worst case, approximately 65% of workers will arrive at the start of the day shift, with the remainder working the night shift.

Table 6.19.4: Estimated Operational Workforce Trip Generation

Scenario	Mode	No. of workers	No. of vehicles	Total peak hour vehicle movements
At shift changeover assuming senior and operational staff arriving at the same hour	Chartered bus from Jermuk (operational staff)	Up to 427 operational staff travel to site	12[2]	24[3]
	Chartered bus from other villages	Up to 200 operational staff to the site	5[2]	10[3]
	Private vehicles (senior staff)	30	20[1]	30[4]

Notes:
1 Assumes 1 senior employee per car
2 Assumes that bus occupancy will be an average of 35 staff per bus
3 Assumes that all chartered buses with an average 35 workers per bus will enter and leave the site during the 1 hour peak period
4 Assumes Senior staff work daytime shift only, will travel to the site and do not leave until end of the shift. However, 10 senior staff will leave the site from the night shit
The total work force is anticipated to be 657, working over two shifts.

Heavy vehicle deliveries are anticipated throughout the operational phase of the Project. Deliveries will be required for equipment spare parts, miscellaneous materials, building supplies and fuel. In addition, a variety of process materials, chemicals and reagents will be needed for input into process operations. Maintenance and service vehicles can also be expected to access the Amulsar site at regular intervals during the operational phase.

All traffic generation calculations for process materials are based on operational throughputs for processing 10 million tonnes of crushed ore per year. This ensures that a worst-case assessment has been made for potential traffic generation for process materials, chemicals

and reagents during the operational phase. The trip generation estimates are as follows (see also Table 6.19.5):

- Lime – 3 trips per day. The deliveries will be through Junction B to the conveyor truck loadout area.
- Activated carbon – 1 trip per month through Junction A to the ADR plant.
- Sodium Hydroxide – 2 trips per month through Junction A to the ADR plant.
- Cyanide (Sodium Cyanide) – Deliveries once per month in a convoy of 3 delivery vehicles. The deliveries will be through Junction A to the ADR plant.
- Antiscalant – 3 trips a month through Junction A to the ADR plant.
- Fuel - 4 trips per day. The deliveries will be through Junction A and B.
- General fleet maintenance, goods and other services will be delivered to the mine on a daily basis; assume up to 11 trips per day through either Junction A or B.
- Four additional LGV trips for food / sustenance will deliver through Junctions A and B.

Operation transport requirements are detailed in Chapter 3 (Section 3.13.2).

Table 6.19.5: Summary of Operational Materials and Equipment Generation

Source	Light Vehicle (VPD)	Heavy Vehicle (VPD)[1]	Daily Traffic Generation (VMPD)[2]
Operational Materials	0	8	16
Cyanide delivery (estimated 20 trips per month in two deliveries)	0	5	10
Fuel	0	6	12[3]
Maintenance	0	10	20
Mine Equipment, and Fleet Vehicle and oversized vehicles	0	1	2
Service Vehicles	4	0	8
Total vehicles per day on cyanide delivery day	**4**	**30[4]**	**68**

Notes:
1 Vehicles per day
2 Vehicle movements per day
3 Total daily vehicle trips consists of an equal number of trips 'into' and 'out' of the site
4 See assumptions above

Traffic Generation during the Closure Phase

The closure workforce would reduce compared to that predicted during operations and although it is difficult to predict at this stage, the majority of this work force are likely to live locally and the requirements for mine employee accommodation at the Jermuk hotel would reduce significantly. Therefore, traffic estimates have been based on local traffic generation from surrounding communities (see Table 6.19.6):

- 25 senior staff on dayshift all of whom live locally and work either at the mine or within the site offices at the ADR plant. These senior staff are assumed to be travelling by car to site;
- 25 operational staff all of which will work day shift and will travel predominately by charter bus on a pick up and drop off basis from Jermuk, Kechut, Gndevaz, Saravan, Saralanj and Gorayk.

Table 6.19.6: Estimated Closure Workforce Trip Generation

Scenario	Mode	No. of workers	No. of vehicles	Total peak hour vehicle movements
At shift changeover assuming senior and operational staff arriving at the same hour	Chartered bus from Jermuk. (operational staff)	Reducing to 10 operational staff within 18 months of cessation of operations	1[2]	2[3]
	Chartered bus from other villages (operational staff)	Reducing to 10 operational staff within 18 months of cessation of operations	1[2]	2[3]
	Private vehicles (senior staff)	25 (assumed)	25[1]	30[4]

Notes:
1 Assumes approximately 1 senior employee per car
2 Assumes that bus occupancy will be up to 35 staff per bus, operating two buses
3 Assumes that all chartered buses will enter and leave the site during the1 hour peak period
4 Assumes Senior staff work daytime shift and cars will park at the mine and approximately 5 senior staff will leave from the night shift

Heavy vehicle deliveries are anticipated throughout the closure phase of the Project. Deliveries will be required for equipment spare parts, miscellaneous materials for closure works, general supplies and fuel. Maintenance and service vehicles can also be expected to access the Amulsar site during the closure phase. In addition, a variety of HGVs will remove plant and equipment from the mine, for resale or reuse on another project and waste materials for recycling or disposal. The predicted vehicle movements during the closure phase have been summarised in Table 6.19.7.

Table 6.19.7 Summary of Closure Phase Materials and Equipment Generation			
Source	**Light Vehicle (VPD)**	**Heavy Vehicle (VPD)**	**Daily Traffic Generation (VMPD)**
Equipment and spare parts	0	3	10
Building rubble and scrap	0	2	10
Fuel	0	2	12
Maintenance	0	5	10
Mine Equipment, and Fleet Vehicle and oversized vehicles	0	1	2
Service Vehicles	4	0	8
Total vehicles per day	**4**	**13**	**52**

6.19.5 Impact Assessment

Highway Links

Potential impacts to the five highways links identified in the baseline were assessed and summarised in Table 6.19.6. The assessment identifies the significance of the impact of traffic volumes based on the majority of all vehicular movements [construction materials / deliveries + staff + management] will enter and egress the Project via the access off the H-42 at Junctions A and B.

This assessment assumes a worst-case scenario where traffic is modelled for shift changeovers. This assumption has been applied for both the construction and operational phases.

Construction Phase

Table 6.19.8 provides the link capacity during the construction phase.

Table 6.19.8: Construction Phase - Highway Links Capacity							
Link Description	**Link Capacity**	**Direction**	**Baseline 2016 (PCU/hr)[1]**	**Traffic at 2016, including construction (pcus)**	**% Increase (PCUs) or magnitude of impact**	**% HGVs)**	**RFC (%)**
Link 1: on H-42 from M-2/H-42 junction to Access A	1380	NB	16	71	229.9	61.0	15.4
	1330	SB	46	96	393.1	46.0	14.1
Link 2: on H-42 from Junction A to Access D	1380	NB	16	83	476.6	69.6	24.8
	1330	SB	46	142	229.9	56.6	26.0

Table 6.19.8: Construction Phase - Highway Links Capacity							
Link Description	**Link Capacity**	**Direction**	**Baseline 2016 (PCU/hr)[1]**	**Traffic at 2016, including construction (pcus)**	**% Increase (PCUs) or magnitude of impact**	**% HGVs)**	**RFC (%)**
Link 3: on H-42 from Access D to Jermuk	1307	NB	64	90	47.3	13.1	7.6
	1380	SB	70	86	26.6	10.5	7.1
Link 4: on M-2 from M-2/H-42 junction to the east	1025	EB	147	263	31.5	29.8	25.3
	855	WB	141	172	25.7	26.8	17.5
Note: PCU = Passenger Car Unit							

Links 1 and 2 both north bound and south bound will experience significant increases in traffic volume (increases of more than 100% to 400% on baseline levels). These links are from the H-42/M-2 junction to the turn-off at access junction D. The ratio of flow to capacity (RFC) remains low (< 26%) for the link between access junction A and D during the peak hour, on the H-42.

The Link to the north of Junction D, to Jermuk will have a modest increase of ~7.6 %RFC. This is due the small proportion of construction related travelling south from Jermuk to the mine.

On the M-2 the %RFC will rise to 25% for both east bound carriageways. Nevertheless, this still indicates that the H-42 and M-2 highways have considerable spare capacity. Based on this assessment, the predicted impacts during the construction phase have been summarised in Table 6.19.9).

Table 6.19.9: Significance of Impacts – Construction Phase					
Link		**Direction**	**Magnitude**	**Geographic**	**Duration**
Link 1: on H-42 from M-2/H-42 junction to Access A	NB	Neutral	Moderate	Local	Short
	SB		Moderate		
Link 2: on H-42 from Access A to Access D	NB		Moderate		
	SB		Moderate		
Link 3: on H-42 from Access D to Jermuk	NB		Low		
	SB		Low		
Link 4: on M-2 from M-2/H-42 junction to the east	EB		Low		
	WB		Low		

The traffic impacts will be significant on the H-42 from the junction with the M-2 to Junction D (Links 1 & 2) both north and south bound. Links 3 to 4 the predicted impact will not be significant.

Operational Phase

To assess impacts on highway links from operational traffic, the predicted traffic under operational conditions was added to the extrapolated 2017 background traffic volumes (the opening year for production at the mine) which includes a high compound growth of 8.3% per annum.

Table 6.19.10 provides the link capacity assessment during the operational phase.

Table 6.19.10: Operations Phase - Highway Links Capacity Assessment

Link Description	Link Capacity	Direction	Baseline 2017 (PCU/hr)	Traffic at 2017, including construction (PCUs)	% Increase (PCUs) or magnitude of impact	% HGVs)	RFC (%)
Link 1: on H-42 from M-2/H-42 junction to Junction A	1380	NB	18	97	562.0	23.7.0	9.5
	1330	NB	50	111	154.0	31.8	12.3
Link 2 & 3: on H-42 from Junction A to Jermuk	1307	NB	70	99	52.8	20.0	9.1
	1380	SB	76	125	81.6	15.7	10.9
Link 4: on M-2 from M-2/H-42 junction to the east	1157	EB	202	249	29.6	23.7	24.3
	1120	WB	153	200	39.0	35.0	23.4

Links 1 both north and south bound will experience significant increases in traffic volume, identified by the magnitude of impact. However, the RFC remains low for each of the links and indicates that both the H-42 and M-2 highways have considerable spare capacity to absorb this additional traffic at the peak hour. Based on this assessment, the predicted impacts for the operational phase have been summarised in Table 6.19.11.

Table 6.19.11: Significance of Impacts – Operational Phase

Link		Direction	Magnitude	Geographic	Duration
Link 1: on H-42 from M-2/H-42 junction to Access A	NB	Neutral	Moderate	Local	Long
	SB		Moderate		
Link 2 & 3: on H-42 from Access A to Jermuk	NB		Low		
	SB		Low		
Link 4: on M-2 from M-2/H-42 junction to the east	EB		Low		
	WB		Low		

The traffic impacts will be significant on the H-42 from the junction with the M-2 to Access A to D (Links 1), both north and south bound. For links 2 to 4 the potential impact during the operational phase will be not significant.

Mine Closure Phase

During the mine closure phase, it is anticipated that:

- The work force will decline to approximately 20 within 18 months of cessation of operations and then for the duration of the closure phase;
- Materials would still be required mainly fuel, materials and services at approximately 20% of the operational load
- All equipment would be removed off site with equipment for resale, reuse or scrap, therefore a proportion of oversize vehicles would be required.
- The main period of mine closure works would take 2 years and continue for a further 3 years, with reduced traffic volumes.

Based on the above, Link 2 would experience a significantly lower vehicular movement than that during the operational phase. Links 3 and 4 would continue to have an impact of low magnitude, therefore not significant. Since the Operational Phase scenarios concluded that the RFC remained low for each of the links, which indicates that the H-42 and M-2 highways have considerable spare capacity, no further capacity assessment is necessary since the impacts of the Closure Phase would be far lower than those of the Operational Phase, and potential impacts would be not significant.

6.19.6 Impact Assessment for Traffic Generation within Affected Communities

Jermuk and Gndevaz will attract traffic generated by the Amulsar Project in the construction and Operations phases. Jermuk is the largest of the affected communities. However, baseline traffic levels within the settlements of Jermuk, Kechut and Gndevaz have been identified as very low, from observations. Site observations also suggest that there are no issues for the safe and efficient operation of local roads within either Jermuk, Kechut or Gndevaz. Due to the location of the mine access roads, both off the H-42, there will be no construction or operational HGV traffic that passes through Jermuk. The majority of construction HGV traffic travelling from the Project will be routed along H-42 around Gndevaz and south towards the M-2 highway. Only light vehicles and mini buses or coaches would travel to and from Jermuk and these trips will relate to staff movements and locals commuting to the mine under shift working arrangements. Outside of the peak commuting hour, traffic to and from Jermuk will be resemble that of the baseline conditions. The magnitude of the traffic impact to Jermuk is therefore Minor and not significant.

Gndevaz is accessed from the H-42 highway, just west of the access to the HLF. No development related HGV traffic would access Gndevaz. Residents of Gndevaz may be

employed during the construction, operational and closure phases of the Project. However, traffic generation is likely to be minimal. Baseline traffic flows show that the H-42 highway carries very low levels of traffic, less than 5% of the potential capacity for this link. Even with allowance for summer traffic variations and high compound growth in background traffic year on year, the additional development traffic has a negligible impact on capacity of the H-42. The ratio of traffic flow to capacity on the H-42 remains below 26% under the construction assessment. The magnitude of the traffic impact within the settlement of Gndevaz in the construction and operational phase is therefore considered to be Negligible and not significant.

Saravan and Saralanj are located directly adjacent to the M-2 highway. This section of the M-2 highway carries a high percentage of heavy vehicle movements, approximately 25% in the baseline flows. The assessment has considered increase travel by both car and HGVs, an estimated total of 30 light vehicles (senior management cars) some of which could travel eastbound along this section of the M-2 highway, although it is likely that the majority would travel west from the H-42/M-2 junction in the direction of Yerevan. It is also important to note that this scenario represents the worst-case assessment for this link and the daily estimated traffic generation will not ordinarily travel within a 1 hour period used in the impact assessment. The assessment predicts that on this section of the M-2 highway during the construction and operations phase the potential impact is Negligible and not significant.

Sections of the highway adjacent to Saravan, Saralanj and Ughedzor are also used by informal fruit and cheese sellers, who are known to set up roadside stalls for passing trade and car traffic. Roadside trading is common practice along the M-2 highway and will not be affected, in terms of HGVs generated by the Project on the road network, during the construction, operational and closure phases. The Project may also result in an increase in business for these traders from passing traffic.

Gorayk will have light vehicles and employee cars only passing through on a daily basis from the geological lab. Traffic impacts to Gorayk are considered to be Negligible and not significant.

The section of highway to the east of Gorayk in particular, and much of the M-2 highway near the Project, is a commonly used route for seasonal herders to bring livestock to pastures within the mine license area. This can amount to hundreds of head of livestock on the highway at peak times in late spring and early autumn. During the construction phase traffic volumes

on the M-2 highway will increase as a result of the development traffic. However, due to the sporadic nature of herding cattle on the highway, potential impacts are temporary in nature and the construction programme can be maintained to avoid conflict with herding patterns. Therefore, the magnitudes of traffic impacts on the M-2, with respect to seasonal herding, are considered to be Negligible and not significant.

6.19.7 Highways Link Impacts

Construction

Impacts to the following highway links have been assessed:

- Link 1: on H-42 from M-2/H-42 junction to Access A
- Link 2: on H-42 from Access A to Access D
- Link 3: on H-42 from Access D to Jermuk
- Link 4: on M-2 from M-2/H-42 junction to the east

Access B & C would be used by the Project during construction, but the volume of traffic using these junction is not sufficient to be included separately in the impact assessment, because all traffic relates to the H-42.

From Table 6.19.8 the highest % RFC predicted for each highway link during the construction period would be:

	% RFC
• Link 1: on H-42 from M-2/H-42 junction to Access A:	15.4
• Link 2: on H-42 from Access A to Access D:	26.0
• Link 3: on H-42 from Access D to Jermuk:	7.6
• Link 4: on M-2 from M-2/H-42 junction to the east	25.3

Based on these results, all four of the links can continue to operate using the existing priority T-junction arrangements with no channelized lanes for turning traffic. Although the magnitude of the impact is significant during peak hours and while the majority of mine related traffic will arrive and depart from Access A, on to the H-42 at the start and end of shifts, industry applied mitigation measures that include the use of buses to transport workers at shift change reduces the magnitude of the potential impact. In addition, other deliveries of machinery, goods and services would be spread throughout the day and would, therefore, further reduce the magnitude of impact and therefore the significance.

Operations

As illustrated in Table 6.19.10 all the road links will remain to operate satisfactorily and within capacity. As such, with such small operations phase trips and low RFC values, it is robust to assume that the development will have no material impact onto the operational capacity of the junctions on the following links:

	RFC
• Link 1: on H-42 from M-2/H-42 junction to Access A	12.3
• Link 2 & 3: on H-42 from Access A to Jermuk	10.9
• Link 4: on M-2 from M-2/H-42 junction to the east	24.3

This analysis is supported by the fact that the Operations phase would not generate as many trips as those during the Constructions Phase and hence the Operations phase is predicted to have less impact and RFC than those identified during the Construction phase. In consequence, the magnitude of the impact is Negligible and not significant.

Closure

As the traffic generation during the closure phase would be less than that during the operational phase there will be a correspondingly lower predicted RFC than those identified during both the construction and operational phases. Therefore, the magnitude of the impact is Negligible and not significant.

6.19.8 Mitigation Measures for Traffic Impacts

There are a range of survey and engineering related infrastructure measures have been identified to mitigate the impact of increased HGV use on the H-42, as a consequence of the Project. These mitigation measures include:

- A formal review of the road network leading to the proposed mine access points is to be undertaken to assess the ability of HGV and low loaders to negotiate the bends and the road network safely.
- Preliminary investigation of the highway network will be undertaken to determine the area of verge that would be lost to implement mitigation measures required for low loaders to negotiate hairpin bends on the H-42.
- Internal road infrastructure will be upgraded to support all required construction activities. Existing gravel surfaced site access roads leading to the mine and HLF will be widened over their entire length and maintained for all weather operation, providing the means of access to the mine site and associated infrastructure. Currently the gravel surfaced roads, off the H-42 to the east of Kechut and Gndevaz,

require upgrading to accept site vehicles and will remain the access roads used for the duration of the Project.

- Formal road signage and potentially the consideration of identifying speed restrictions will be implemented in order to alert general traffic to the possibility of vehicles turning into and out of the junctions on the H-42 (see Appendix 6.19.1).

A Transport Plan (TP) has been prepared (see Appendix 8.10) and includes the formal arrangements to minimise and mitigate the impact on the tourist traffic travelling to Jermuk within summer months. The TP also requires signage on both the M-2 and H-42 to direct Project related traffic to the Junction A, B and D on the H-42.

The TP also describes the measures that Lydian would undertake to minimise disruption, inconvenience and delay to road users, without compromising safety. The TP requires the documenting of details required for temporary traffic management and the period over which they will be in place.

6.19.9 Monitoring and Audit (see also TP, Appendix 8.10)

The monitoring and audit planning required to validate the effectiveness of the mitigation strategies have been identified in Table 6.19.12.

Table 6.19.12: Transport Monitoring and Audit

Transport		
Monitoring approach	Baseline	• A programme of traffic counts at junctions on the M-2 and H-42 (see Chapter 4, Section 4.18). • A programme of speed, payload road condition monitoring; • Minimising the number of trips generated by the Project, particularly where staff movement is involved and minimising the impact of all development traffic on community, heritage and environmental receptors; • A programme of drivers / staff training, fatigue management and driver behaviour monitoring; and • Journey Management Plans.
Level 2 Management Plan	A Transport Plan (TP, Appendix 8.10) has been produced, providing the details of mitigation measures to control (a) impact to the highway infrastructure and (b) emissions from Project vehicles using the local and national highway network. This includes driver awareness for all company employees, using their own transport for travel to and from the Project	

Table 6.19.12: Transport Monitoring and Audit	
Transport	
Level 3 SOPs	The TP is in force and will be underpinned by four SOPs that will provide specific guidance on monitoring for maintenance of the highway network and traffic counts: • Pre-construction road survey of the H-42 to establish the condition of the road and identify those areas of the road where specific widening is required and where the access junctions to the mine will be constructed. • Annual roads survey and traffic counts at road links selected for baseline surveys to audit capacity of links and record any variation in road use in comparison to baseline – report back and update TP, as necessary. • Driver awareness surveys, to update all employees on the requirements of the TP. All new employees and contractors and annually for all staff. • Signage for mine traffic (Appendix 6.19.1). • Random audit of Project related traffic, routing, vehicle speed and safety, signage to inform TP and driver awareness surveys

6.19.10 Residual Traffic Impacts

The combined impact of the transport requirements of the construction phase will be low and not significant. The primary mitigating measures will be those which lessen the impact of transporting the construction materials and equipment, and particularly the oversized loads that require access to the Project during the construction phase.

Measures to reduce the traffic impact of transporting workers off site or on shift change over days will also assist with lessening the impact on the H-42 / M-2 highways.

The combined residual impact of most of the transport requirements of the operational phase will be Negligible, increasing to Low at peak hours and not significant. Mitigation measures would be those which lessen the impact of transporting the operational workforce, materials and equipment. The Amulsar Project will require regular transportation of hazardous chemicals, including twice monthly deliveries of cyanide in truck convoys. The delivery of hazardous chemicals will require specific monitoring and conform to international health and safety standards (considered in the Cyanide Management Plan, Appendix 8.11).

Table 6.19.13 summarises the traffic related impact assessment.

Table 6.19.13: Summary of Project Traffic Related Impacts

Impact	Source	Primary Receptor (1)	Phase (2)		Significance (3)		Mitigation Measures	Management Plan
			C	O	ST	LT		
Highway link assessment Construction Operations Closure	Light vehicle. Heavy goods vehicle	O O O	X	X X	M- M- N	N N N	• HGVs and oversize vehicles will be subject to management and driver safety awareness training. • Hazardous chemicals will be transported appropriately • ICMC requirements will be applied for transportation of cyanide • Car journeys will be minimised where possible, through use of buses and car sharing.	Transport Plan, and Cyanide Management Plan (Appendix 8.10 and Appendix 8.11)
Junction link capacity Construction Operations Closure	Light vehicle. Heavy goods vehicle	O O O	X	X X	N N N	N N N	• Car journeys will be minimised where possible through use of buses and car sharing	Transport Plan (Appendix 8.10)
Environment – Project Affected Communities Construction Operations Closure	Light vehicle. Heavy goods vehicle	R R R	X	X X	M- M- N	N N N	• Car journeys will be minimised where possible through use of buses and car sharing	Transport Plan (Appendix 8.10)

Notes:
O – impact associated with the capacity of the highway and associated junctions to accept increase in traffic associated with the Project
(1) Primary Receptors: E = employees, R = residents, Fl = flora, Fa = fauna, O = Other, (see notes)
(2) Project Phase: C = Construction, O = Operations
(3) Expected Significance Rankings: ST = short-term with mitigation, LT = long-term with mitigation, MA = major, M - = moderate, Mi = minor, N = negligible

6.19.11 Conclusion

A Traffic Impact Assessment has been undertaken to assess the effects of the Project by consideration of the construction, operation and closure phases of the mine.

Impacts to the following highway links have been assessed:

- Link 1: on H-42 from M-2/H-42 junction to Access A (Construction and operational phases)
- Link 2: on H-42 from Access A to Access D (Construction phase only)
- Link 3: on H-42 from Access D to Jermuk (Construction phase only)
- Links 2 & 3 from Access A to Jermuk (Operation phase only)
- Link 4: on M-2 from M-2/H-42 junction to the east (Construction and operational phase).

The findings of the assessment are:

- The combined residual impact of most of the transport requirements of the operational phase will be Negligible, increasing to Low at peak hours and not significant.
- Mitigation measures include those which lessen the impact associated with transport at the shift change for the operational workforce and traffic related to the supply of materials and equipment. The Amulsar Project will require regular transportation of hazardous chemicals, including twice monthly deliveries of cyanide in truck convoys. The delivery of hazardous chemicals will require specific monitoring and conform to international health and safety standards, which have been defined in the CMP (see Appendix 8.11).
- As the traffic generation during the closure phase would be significantly less than that during the operational phase there will be significantly lower predicted RFC than those identified during both the construction and operational phases. Therefore, the magnitude of the impact is Negligible.
- A Transport Plan (see Appendix 8.10) has been prepared which describes the measures that Lydian would undertake to minimise disruption, inconvenience and delay to road users, without compromising safety.
- As such, it is concluded that the potential impacts of mine vehicular movements on the highway during construction, operation and closures phases can be mitigated and the residual effects are not significant.