

9.1.3 ЕЛЕКТРИФИКАЦИЯ, СИГНАЛИЗАЦИЯ И ТЕЛЕКОМУНИКАЦИИ

(1) Електрификация

Понастоящем са електрифицирани над 2 478 км от жп мрежа, което представлява 62% от цялата мрежа на БДЖ (Фиг.91.3-1).

Това е един значителен дял от общата дължина на жп мрежа, като се има предвид, че средният процент в света е 18.8% (1992 г.), а съотношението в японските железопътни линии е 58%. Електрическата тяга за км също доминира в БДЖ, като съставлява 85% от общата.

1) Система на електрификация

Системата на електрификация на БДЖ се състои от директно захранване за тяговото ел. снабдяване и въздушна контактна мрежа за ел.захранване на подвижния състав.

Следва преглед на характеристиките на захранващата мрежа.

Преглед на характеристиките на захранващата мрежа

- * Електрозахранване: 110 kV, 50 Hz за цялата републиканска система (без изключение)
- * Захранване: Директно, АС 50 Hz, 27.5 kV (релсите служат за обратна верига)
- * Контактна система с подвижния състав: обикновено контактната мрежа е АС 50Hzq 25kV
- * Допустимо регулиране на напрежението: 19 kV-29 kV
- * Ниво на отклонение при получаване на енергия: 2 300 - 3 800 MVA
- * Импеданс на еквивалентна захранваща мрежа : $Z=0.114\cos \theta + 0.305\sin \theta (O)$
($\cos \theta$: енергиен коефициент на подвижния състав, средна стойност 0.74)
- * Мерки срещу индуцираните смущения в телекомуникационните вериги:
кабели със защитна обвивка, заровени под земята по продължение на трасето

2) Подстанции

Всичките 47 тягови подстанции са включени в системата, като на всяка подстанция се пада захранването на приблизително 53 км. Между всеки две подстанции има секционен пост за предвратяване на междуфазно късо съединение и за захранване на мрежата при аварийни схеми.

Натоварването на подстанциите на БДЖ понастоящем е около 60% от проектното, което се дължи на намалената честота на преминаването на влаковете.

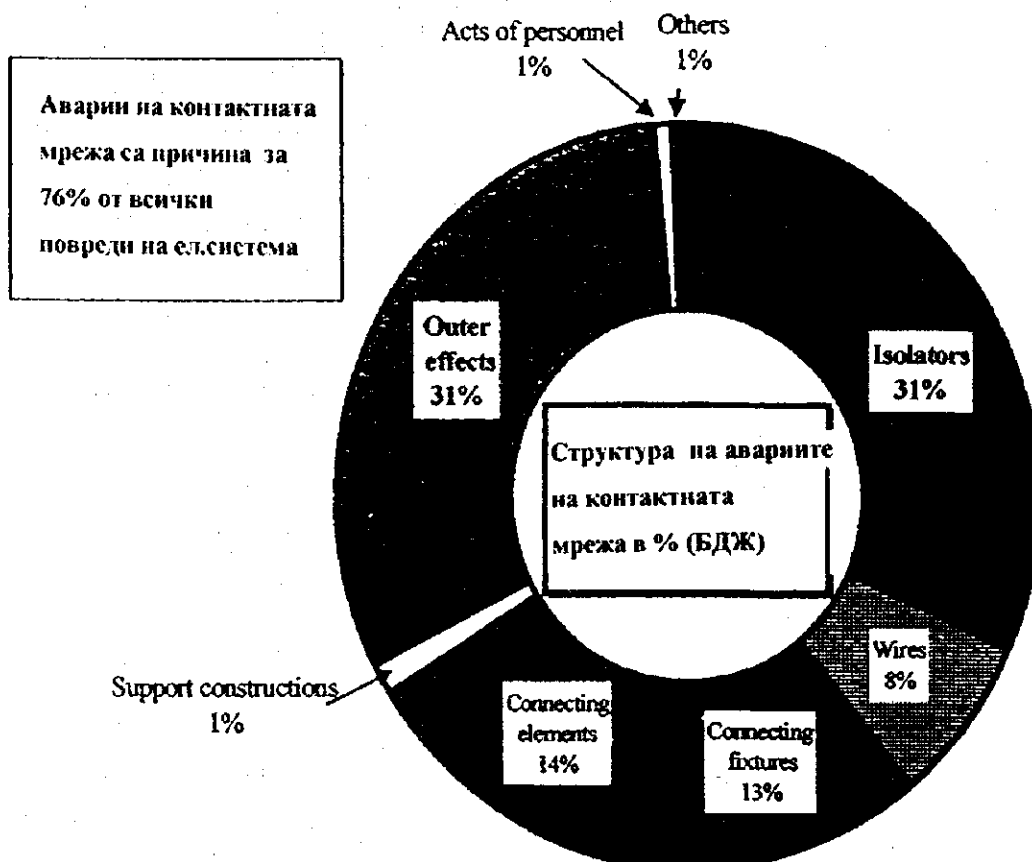
(3) Контактна мрежа и оборудване

В момента в БДЖ има три вида контактна система в зависимост от проектната влакова скорост и изискваните електрически товари, с обща дължина 6 776 км.

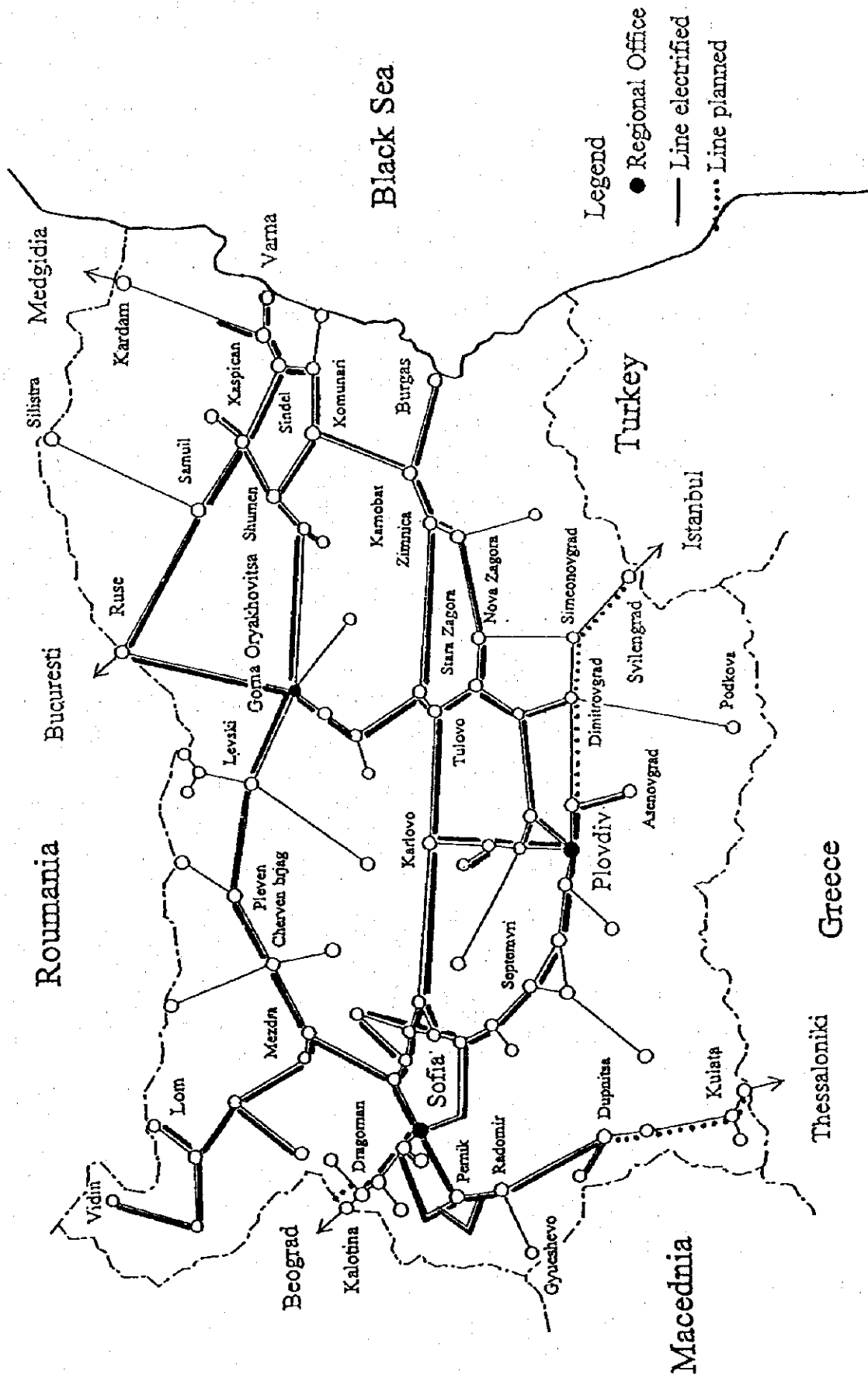
Контактната система от типа "компенсирана верижна контактна мрежа" е разработена от специалисти в БДЖ и е приета с оглед на поемане на по-големи товари и влакови скорости по-големи от 100 км/час (според специалистите в БДЖ тя е с капацитет до 160 км/час).

4) Въпроси за разглеждане

Най-честите повреди и прекъсвания на ел. захранване в БДЖ се дължат на изолаторите на шарнирните конзоли и свързващите клеми и елементи, т.е на контактната мрежа. Тези аварии съставляват около 60% от всички повреди на контактната мрежа, включително и причинените от външни фактори. (Фиг.9.1.3-2)



Фиг.9.1.3-2 Описание на аварияте по електрозахранването



Фиг. 9.1.3-1 Електрифицирана жи мрежа на БДЖ

(2) Сигнализация

1) Влагова блокировка и сигнална система

а) Автоматична блокировка

Автоматичната блокировка служи за автоматично разпознаване на сигналите от движещ се влак посредством непрекъснатата верига, благодарение на което тази блокировка се счита за една от най-надеждните.

Системата е въведена само в участъците София - Карлово по Главна ж.п. линия № 3 и София - Пловдив по главна ж.п. линия № 1 и други къси участъци, с обща дължина 347 км (приблизителен дял 8.6%)

София - Карлово : 165 км (Производител СССР , 1972 г.)

София - Пловдив : 164 км (Производител БДЖ - ЗАТ, 1985)

ЗАТ - Завод за автоматика и телемеханика

б) Полуавтоматична блокировка

Понастоящем полуавтоматична блокировка е приложена в повечето участъци в БДЖ, като общата им дължина е 3 190 км (приблизителен дял 79%).

Тази система е предназначена за блокировка от гара до гара, няма вериги по продължение на трасето, а сигналите се предават само между две гарии. Затова тази система се приема за неуказваща блокировъчна система. Тъй като в близост до изходния и входния светофор са монтирани сигнални вериги с малка дължина като същевременно са свързани със сигналните устройства, стрелките и апаратите за блокировка, може да се смята, че е осигурено безопасно маневриране и движение на влаковете.

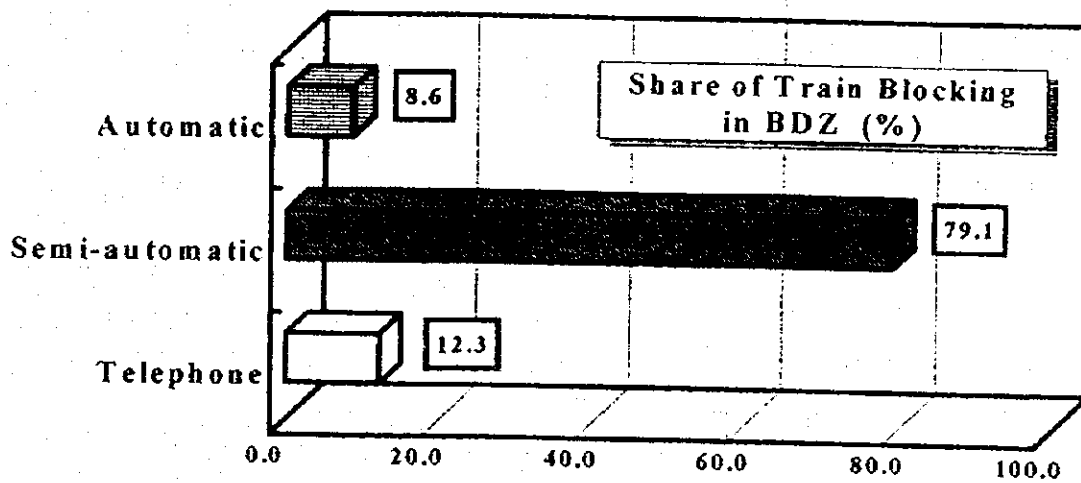
Приложението на тази система обаче неизбежно ограничава честотата на преминаване на влаковете между гарите, както поради блокирането между гарите (което по принцип позволява да има само един влак в една блокирана зона), така и поради действащия инструмент за блокировка.

Тъй като при тази система липсва непрекъснатата релсова верига по продължение на трасето между гарите, добре би било да се монтират и броячи на оси на гарите с цел подобряване на безопасността, при условие, че движението не е много натоварено.

в) Телефонна блокировка

Освен споменатите по-горе участъци, има и такива само с телефонна блокировка и те съставляват около 12% от цялата ж.п. мрежа (494 км).

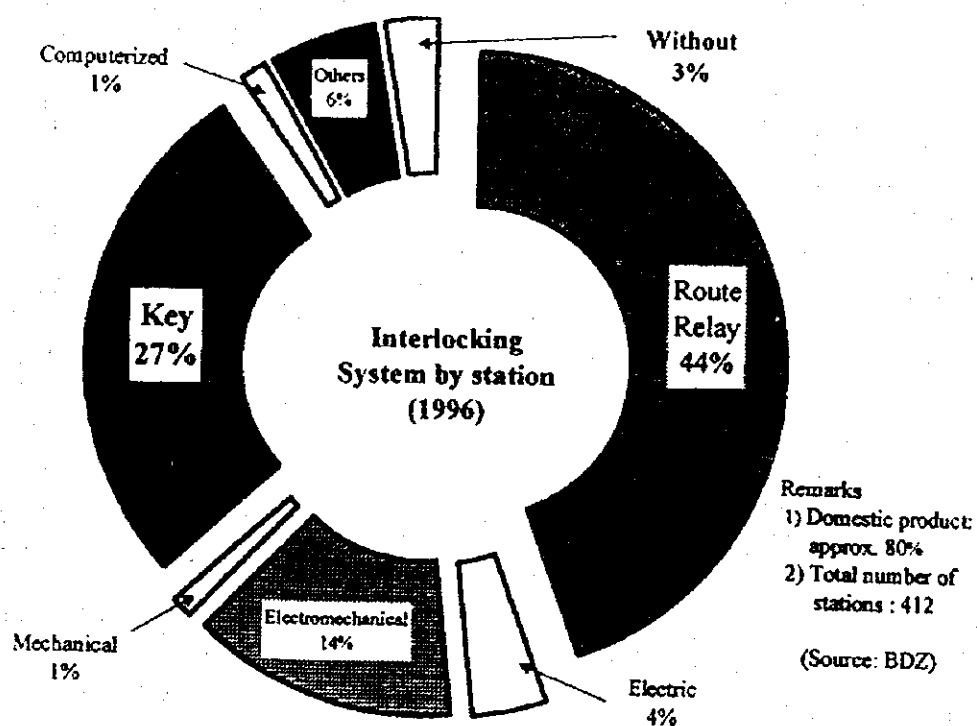
При тази система само един влак може да навлезе в дадено междугарие след получено по телефона разрешение, т.е. безопасността на движението е зависима от човешкия фактор.



Фиг. 9.1.3-3 Схема на системата за блокиране на влакове

2) Блокиращи устройства

Системи за блокировки, които се използват в БДЖ сега са класифицирани на Фиг. 9.1.3-4



Фиг. 9.1.3-4 Схемa на блокиращата система на БДЖ

Класифицираните по-горе устройства се подразделят на широка гама от видове (повече от 15) в зависимост от производители и година на производство, което поражда трудности

при поддръжката и ремонта им (за обучение на персонал за поддръжката им, осигуряване на резервни части и реконструкция).

Блокиращите устройства се използват от сравнително дълго време. Те се оценяват като остарели. Следва описание:

| Категория блокиращи устройства | Експлоатационна годност |
|--|-------------------------|
| 70% от маршрутно-релейните и електрически блокиращи устройства | над 20 год |
| Електромеханични блокиращи устройства | от 1930 – 1959г. |
| Механични блокиращи устройства | от 1940г. |
| РУКЗ | от 1940-1960 |

Устройствата за РУКЗ се задействат чрез механично обвързване на сигналите със стрелките, при което обаче стрелките трябва да се управляват ръчно на място. Вече не се допуска изграждането на нови РУКЗ, но дори по магистралните трасета като главна ж.п. линия № 5 например, все още се използват такива устройства.

Друг особено важен за безопасността на влаковото движение проблем е, че 11 гари не са оборудвани с никаква система на блокиране.

3) Локомотивна сигнализация и автоматичен контрол на скоростта

В БДЖ все още не е въведена абсолютна надеждна система за спиране на влака, като се изключат участъците с въведена Автоматична Локомотивна Сигнализация (АЛС).

Споменатата абсолютно надеждна система за спиране трябва да действа подобно на автоматична спирачка, която принудително спира влака, ако машинистът не е реагирал на стоп-сигнала.

АЛС е въведена в участъка от София до Пловдив (164 км) по главна ж.п. линия №1, с цел контрол на скоростта на влака и безопасност на движението. Системата е въведена през 1989 г., въз основа на шведска технология и се състои от импулсни приемо-предаватели, разположени периодично по продължение на трасето и от приемно устройство в кабината на локомотива (в момента устройството е монтирано на 103 локомотива), чрез които се контролира скоростта на влака според подадените сигнали.

4) Контрол на движението

Контролът на движението в БДЖ се осъществява от Диспечерски център, като диспечерските команди към гарите и машинистите се дават по телефона.

Всички диспечерски команди и размяна на съобщения се записват в Диспечерския център.

Централизиран пътен контрол (ЦПК) е въведен по единичната линия София - Карлово (165 км от Главна ж.п. линия № 3), и допълнително по двойната линия София - Пловдив (164 км от Главна ж.п. линия № 1).

Предишната система с вградени релета и полупроводници е била доставена от СССР през 1972 г., а по-късно монтираната компютъризирана система е внесена от Словения през 1987 год.

(3) Телекомуникации

1) Трансмисионни вериги и трансмисионна система

Съобщителната мрежа в БДЖ се състои от около 3 550 км комбиниран кабел четворка, главно за главните артерии, който е положен на 80 см под земята по продължение на ж.п. линията.

Кабелът има две външни защитни обвивки от алуминий и стомана за предвратяване на външните смущения от тяговата ел. мрежа, както и на кражди.

Някои от кабелите са много стари, особено в участъка Червен бряг - Горна Оряховица (Главна линия №2), София - Карлово (Главна линия №3) и Русе - Горна Оряховица (Главна линия № 4).

На места кабелите все още имат резервен капацитет, но на други се ползват изцяло. Особено критично е положението по линията Мездра - Горна Оряховица, където всичките 48 поста са заети. Подобно е положението и по линията София - Карлово.

Въздушни открити стоманени проводници се използват главно за някои второстепенни клонови линии (750 км), като в основната си част са остаряли и ненадеждни.

Използваните в БДЖ главни трансмисионни системи са аналогови с мултиплексно честотно делене (FDM), като по-голямата част от съоръженията са на 20 или повече години. С нарастването на съобщителния поток, за предпочитане е аналоговата система FDM да бъде заменена със система за мултиплексно временно делене (TDM) с импулсна кодова модулация (PCM), а кабелите на трансмисионните вериги да се заменят с коаксиални или оптични кабели.

3) Телефонни централи

Телефонните връзки в БДЖ се осъществяват посредством частни централи на три равнини, с общ брой на постове 25 700.

Първата равнина се състои от частни автоматични телефонни централи, разположени в София, Горна Оряховица, Варна, Стара Загора и Пловдив. Те включват общо 10 500 телефонни поста. Това са много стари **стъпкови централи** на Сименс, датиращи от 1930 г., но в момента са в процес на бърза подмяна с цифрови.

(4) Влакови радиовръзки

По настоящем радиовръзките покриват голяма част от главните ж.п. линии (1 595 км). Допълнително са завършени около 80% от системата в участъка от Русе до Горна Оряховица по Главна ж.п. линия № 4, планирано е и изграждане на система до границата с Гърция на Главна линия №5.

400 главни локомотива и ЕМВ-та са снабдени с необходимото портативно оборудване. 450 маневрени локомотива, представляващи 75% от целия парк, са оборудвани с радиопарати, които се използват при маневриране в зоната на гарите.

В момента един от основните проблеми на радиовръзките в БДЖ е наличието на зони с ниска чуваемост, каквито например са тунелите и планинските участъци.

(5) Инфраструктура за пренос на данни

Инфраструктурата за предаване на данни в БДЖ се състои от две основни системи, а именно Телекс и X.25.

Телексът се използва все още активно в БДЖ. По-голяма част от информацията, обменяна по телекса, представлява потвърждения на съобщения за композицията на влаковете, съдържанието на товарите във вагоните и т.н.

Главно предимство на телексните връзки обаче е не толкова в по-добрата им експлоатационна пригодност, а по-скоро в това, че покриват много райони, в които не е въведена системата X.25.

Освен това телексът играе важна роля в БДЖ като система за архивиране на данни и/или като канал за връзка при аварийни ситуации.

Системата за предаване на данни, наречена X.25 ("пакетно превключване") е въведена в БДЖ първоначално през 1984 г. от фирмата Syscom (Лихтенщайн). Тя играе частично и роля на **Информационна Система на БДЖ**.

X.25 мрежата се състои от пакетни превключватели X.25, разположени в четири главни пункта (София, Пловдив, Горна Оряховица и Варна). Вторични пунктове (в частност

граничните пунктове) са свързани с концентраторите посредством пакетни събиратели и разклонители (PAD).

Концентраторите са свързани и с Главния информационно изчислителен център (ГИИЦ) и с Централата на БДЖ в София. Апаратурата за концентраторите е свързана в мрежова конфигурация чрез специално определени за целта аналогови канали от съобщителната FDM инфраструктура на БДЖ. Модемите по тези основни канали работят със скорост 19.2 кб/сек., но няма изгледи за постигане на чувствително по-голяма скорост на информационния поток. Модемите, които свързват вторичните пунктове с основните работят със скорост 9.6 кб/сек.

Съществен недостатък на съществуващата сега система за предаване на информация е липсата на инструменти за управлението ѝ, т.е. липсва възможност за контролиране както на работните ѝ параметри, така и на начина на използването ѝ. Затова се налага в най-скоро време да бъде усъвършенствана и приспособена към далеч по-интензивния информационен поток, който ще се създаде след въвеждането на MIS (Управленска информационна система).

9.2 ПОДДЪРЖАНЕ И ИНВЕСТИЦИИ

9.2.1 Основен замисъл

(I) Възобновяване на отложените ремонтни работи

Правилното поддържане на инсталациите и съоръженията е от жизнено важно значение за ефективното управление на жп индустрия. В противен случай, има опасност от разстройване на движението на влаковете, както и сериозни вреди, причинени от загуба на общественото доверие към жп транспорт.

При обсъжданията с партньорите от БДЖ, както и от проведените проучвания на място, Консултантът разбра, че през последните десет години инвестициите за поддържане на съоръженията и подвижния състав са били недостатъчни. Затова има изоставане на необходимите ремонти и подмяна на съоръженията. Повече подробности са дадени в 9.2.3.

Намаляването на средствата за поддръжка през последните десет години вероятно ще се отрази на редовното движение на влаковете в бъдеще. Това явление е вече наблюдавано в други развиващи се страни.

В миналото, БДЖ предлагаше сравнително добро железопътно обслужване по отношение на безопасността и спазване на разписанията. Това добро наследство трябва да се запази и в бъдеще.

Следователно, Проучвателният екип препоръчва да се даде предимство на **възобновяването на отложените ремонтни работи, включително потягане или подновяване на съоръженията в съответствие с предвижданите характеристики на линиите.**

Тази политика трябва да се изтъкне също така, предвид необходимостта от подготовка за резултатно интегриране на БДЖ в европейската жп система и за повишаване на технологично ниво, необходимо за тази цел.

В следващия параграф 9.2.3 се дават препоръки за степента и нивото на това възобновяване на ремонтните работи.

(2) Нови проекти

Превозният капацитет на БДЖ почти съответства на този от преди около десет години. Но действително оползотворяваните възможности се изчисляват на 55% в товар тон-километър и 65% в пътник-километър от тези през 1990 година. Очевидно е, че БДЖ разполага с излишен превозен капацитет.

Прогнозата на транспортните нужди предвижда обща стагнация на превозите доста след 2010 година.

Откупуващи инвестиции за качествени подобрения на обслужването понякога стимулират търсенето и повишават духа на служителите. Но сегашното икономическо положение на България не насърчава рискови инвестиции. Финансовите перспективи на БДЖ също действат възпиращо за мащабни инвестиции.

Като цяло, Проучвателният екип счита, че инвестиционната политика на БДЖ по принцип трябва да бъде консервативна.

Макар и консервативна, тази политика обаче трябва да отчита следните моменти:

- Общоевропейските тенденции, ориентирани към развиване на международен КТ (Вж.Глава 4).
- Възможността за увеличаване на оперативните приходи чрез извършване на бързи и чести пътнически превози.
- Възможността за намаляване на оперативните разходи чрез подобряване на ефективността, икономия на енергия и т.н.

Следователно, новите проекти ще бъдат доста ограничени, както е описано по-долу.

а. Модернизация на товаропревозната система

Обсъждането на безконфликтния комбиниран транспорт трябва да се извърши с предимство, като се има предвид интеграцията в европейската железопътна транспортна система и възможността за увеличение на приходите. В 9.2.4 са дадени повече подробности.

б) Увеличаване на транспортния капацитет

За доходните линии/сегменти със сравнително голяма честота на преминаване на влакове и ограничения при определяне на влаковата диаграма, трябва да се вземат приоритетно мерки за увеличаване на превозния капацитет. Тези мерки включват удвояване на линиите, въвеждане на автоматична сигнализация и др.

в) Увеличаване на скоростта на движение на влаковете

За доходните линии/сегменти, за които се очаква увеличение на движението на влакове ще бъде ефективно "намаляване на времето за пътуване от край до край", а същевременно постигането на по-висока скорост на движение ще допринесе стратегически до подобряване на представата на пътниците за жп обслужване и ако нещата вървят добре - до по-големи приходи.

г) Други

Разглеждат се проекти за икономия на енергия, увеличаване на безопасността, увеличаване на производителността и т.н. (Например: електрификация, ЦЖ).

Новите проекти са описани с проектометри в Табл. 9.2.4 и 9.2.5.

9.2.2 Подбор на линии

Планирането започва с подбор на линиите с по-добри пазарни перспективи.

При подбора се взимат предвид следните фактори:

- Сегашното движение или броят на движещи се влакове (от което се разбират характеристиките на експлоатацията).
- Връзката на линията с други важни транспортни пътища (и особено международните връзки).
- Данни за рентабилността на линията (процент на възвръщаемост на разходите и др.).
- Общи предвиждания за бъдещите нужди.
- Сегашните транспортните възможности и схема на линията.
- Предвиждания за социалното значение.
- Обща съвместимост и съгласуваност с изискванията за управление на БДЖ.

Консултантският екип си позволи да избере следните линии/сегменти, за които да се съсредоточат инвестициите за поддръжка и нови проекти.

Линия №1, Линия №2, Линия №3, Линия №4, Линия №5, Линия №6 (с изключение на участъка от Радомир до Гюешево), Линия №7, Линия №8, Линия №9, Линия №82 (участъка от Пловдив до Карлово) и Линия №83

Общата дължина на гореспоменатите линии/сегменти съставлява около 66% от мрежата на БДЖ, а тяхното средно съотношение на възвръщаемост на разходите е 95,8%.

Повече подробности за размерите са дадени в "5.1 Железопътна мрежа (Глава 5)".

9.2.3 Възобновяване на отложените ремонтни работи

(1) Подвижен състав

В момента БДЖ полага големи усилия да изпълни плана за съкращаване на вагонния парк, както и на плана за оздравяване на подвижния състав в съответствие с ППЖ. Когато завърши изпълнението на ППЖ броят на подвижния състав и възрастта му ще бъде както е показано на Табл.9.3.2-1.

Таблица 9.2.3-1 Предвиждания за обема на инвентара в 2000 г. според ППЖ

| | Предвиждания за инвентара в 2000 (ППЖ) | Инвентар по възраст в 2000 година | | | | |
|---------|--|-----------------------------------|--------------|--------------|--------------|-----------------------|
| | | Над 30 год | 25~30 години | 20~25 години | 15~20 години | По-малко от 15 години |
| ЕЛ | 252 | 10 | 66 | 73 | 59 | 44 |
| ДЛ | 145 | | 104 | 28 | 3 | 10 |
| Шунтови | 203 | | 113 | 70 | | 20 |
| ЕМВ | 83 | | 55 | 22 | | 6 |
| ДМВ | 6 | 6 | | | | |
| ПВ | 1 449 | 33 | 464 | 459 | 137 | 356 |
| ТВ | 21 500 | | | 3 838 | 10 116 | 7 546 |
| ОБЩО | 23 638 | 49 | 802 | 4 490 | 10 315 | 7 982 |

В Табл.9.2.3-2 са дадени данни за предвижданата подмяна или подновяване на подвижния състав.

Както беше споменато в предишния параграф 9.2.1 извършването на подходяща поддръжка (особено на подвижния състав) е абсолютно необходимо за подготовката за интегриране в европейската жп система. Следователно, в основния ремонт и подновяване на вагонния парк трябва да се включи и подобрене на вагоните и машините.

Въпроси за разглеждане

- В момента поради недостиг на средства подвижният състав често е обект на “канибалски” ремонти. Тази практика трябва да се ограничи максимално.
- Трябва да се осигурят достатъчно количества препарати за почистване на вагоните за да се направи по-удобно пътуване на клиентите.
- ДДС и вносните мита са тежко финансово бреме при покупката на вносни превозни средства и резервни части. Таксите трябва да се намалят максимално чрез преговори със съответните организации.

Таблица 9.2.3-2 План за подновяване на подвижния състав

| | Предвиждания за инвентара в 2000 (НПЖ) | План за подновяване или подмяна (на 5 години) | | | | |
|-------------|--|---|--------------|--------------|--------------|--------------|
| | | 2000~2004 | 2005~2009 | 2010~2014 | 2015~2019 | 2020~ |
| ЕЛ | 252 | 43 | 70 | 66 | 52 | 21 |
| ДЛ | 145 | 52 | 66 | 16 | 7 | 4 |
| Маневрени | 203 | 56 | 92 | 35 | 10 | 10 |
| ЕМВ | 83 | 30 | 36 | 11 | 3 | 3 |
| ДМВ | 6 | 6 | | | | |
| ПВ | 1 449 | 265 | 462 | 298 | 247 | 177 |
| ТВ | 21 500 | | 1 919 | 6 977 | 8 831 | 3 773 |
| ОБЩО | 23 638 | 452 | 2 645 | 7 403 | 9 150 | 3 988 |

Забележка: 1) Цифрите в Табл.9.2.3-2 включват покупка на подрижен състав за подновяване, но не включват покупка на вагони за стратегически проекти.

2) Цифрите в Табл.9.2.3-2 отразяват средния брой на товарния състав, класифициран по възраст, а не по вероятен брой на експлоатационни км.

(2) Релсов път и съоръжения

В момента БДЖ полага усилия за ускорено изпълнение на Проекта за реструктуриране на железниците (ПНДЖ). Този план обаче покрива само неотложни и жизненоважни нужди за поддръжката на БДЖ до 1998 година.

За усъвършенстване на управлението на БДЖ и оттам осъществяване на ръст на българската икономика е необходимо да се изработи дългосрочен план за поддръжка. Въз основа на извършените от Консултантския екип проучвания се предлагат следните проекти за поддръжка.

Проект за поддръжка

1) Съоръжения, които се поддържат

Това са съоръжения, за които е необходима редовна поддръжка и съоръжения, и за които е необходима подмяна съобразно остаряването (подмяна и ремонтване).

(а) Редовна поддръжка

Редовната поддръжка, която се извършва през цялата година, включва следните работи:

- 1) Поддръжка на отводнителната система на основата на трасето;
- 2) Поддръжка на релсовият път (включително коригиране на напречните наклони при завоите и попълване на баластра);
- 3) Пребойдисване на мостове;
- 4) Отстраняване на течове в тунели;
- 5) Ремонти на сгради и т.н.

(б) Подмяна и ремонтване

Необходимо е извършване на подмяна и ремонти на съоръженията поради остаряването им както следва:

1) Подмяна с безнаставни релси

За да се предотврати изместване на релсите и увеличаване на удобството на пътуване необходимо е късите релси да се подменят с безнаставни за участъците със скорост от 100 км/час или повече.

2) Подмяна с тежки релси

Необходимо е полагане на тежки релси в съответствие с тежестта на превозваните товари.

3) Подмяна на стрелки

Повечето стрелки са достигнали проектната си възраст и трябва да бъдат подменени със стрелки, проектирани за скорост на влаковете 130 км/час.

- 4) Строителство и ремонти на мостови конструкции
- 5) Разширяване на напречното сечение на тунели

2) Стандарти за бъдещото усъвършенстване на съоръженията (проектни)

Когато извършва подмяна или ремонти на съоръжения с дълъг проектен живот БДЖ трябва да се съобразява с възприетите в Европа бъдещи стандарти. Стандартите (проектни) трябва да са в съответствие с жп система, при която скоростта на движение на влаковете ще продължи да се повишава.

Стандарти за усъвършенстване на съоръженията (проектни)

| | |
|---|--|
| Участъци, където се прилагат тези стандарти | Линии № № 1, 2, 3, 4, 5, 6, 7, 8, 9, 82, 83 |
| Единични или двойни | Варират в зависимост от оперативния план |
| Захранване | Електрификация с променлив ток 25 kv |
| Междусис (ширина на жп линия) | 1 435 мм |
| Проектирана максимална скорост | До и над 130 км/ч (новите линии до и над 200 км/ч) |
| Минимален радиус на крива | 2 500 м (стандарт 4 000 м) |
| Най-стръмен наклон | Пътническа линия: 35% Товарна линия: 12% |
| Проектни габарити | Стандарт UIC (система Ro-La) |
| Тегло на релсите | 49 кг/м или 60 кг/м |
| Дебелина на баластрата на трасето | 33 мм и повече |
| Широчина на строителната основа | Съобразно диаграмата на БДЖ |
| Товарен капацитет на мостовете | 23 тона (стандарт UIC) |

3) График на проекта за поддръжка

| | | 2009 година | |
|-----|---|-------------|-----------|
| | | 2000 год. | 2019 год. |
| (1) | Редовна поддръжка | | |
| | 1) Отводняване | | |
| | 2) Коригиране на напречните наклони при кривите | | |
| | 3) Попълване на баластра | ← | → |
| | 4) Пребойдисване на мостовете | | |
| | 5) Отстраняване на течове в тунели | | |
| | 6) Ремонти на сгради | | |
| (2) | Подмяна и ремонтране | | |
| | 1) Подмяна с безнаставни релси | ← | → |

| | | | |
|----|---|----|----|
| 2) | Подмяна с тежки релси | ←→ | |
| 3) | Подмяна на стрелки | ←→ | |
| 4) | Строителство и ремонти на мостови структури | | ←→ |
| 5) | Разширяване на напречното сечение на тунели | | ←→ |

(3) Електрификация, сигнализация и телекомуникации

Основните инвестиционни планове за поддръжка на електрическите инсталации са както следва:

1) Подмяна на контактните мрежи

Обикновено износването на контактните кабели е пропорционално на броя на пантографните преминавания.

При нормално поддържане подмяната на контактните мрежи се осъществява съобразно пантографните пасажи, протоколите за аварии, превозваните товари, продължителността на действие, значението на жп линия и т.н.

Когато изпълнението на ППЖ завърши, продължителността на действие на инсталираните контактни мрежи ще се класифицират според удължаването на кабелите както следва:

- над 30 год 10%, - над 25 години 8%, - над 20 години 24%

Както беше споменато в предишния параграф в контактната система на БДЖ често стават аварии, особено на свързващите клеми и елементи.

Следователно подмяната трябва да се извършва на приоритетен принцип.

(Например: Линия №3, Линия №2, Линия №1...)

2) Подобрене на верижните прекъсвачи, изключващи устройства в тяговите подстанции

Верижните прекъсвачи в тяговите подстанции са от решаващо значение за предотвратяване на тежки катастрофи по линиите.

Свърхизносените устройства маслен тип трябва да бъдат постепенно подновени с вакуумни.

3) Преминаване от система на "РУКЗ" към система на безотказни блокиращи устройства

Системата от блокиращи устройства, проектирана за блокировка на сигнали на местата със стрелки, трябва да осигурява безопасно движение по всяко време. Освен това, експлоатационните изисквания за тези механизми са максимално бързо действие предвид увеличаването на честотата на преминаване на влакове.

Устройствата за РУКЗ се задействат чрез механично обвързване на сигналите със стрелките, но стрелките трябва да се управляват ръчно на място.

РУКЗ са инсталирани в около 72% от всички гари на БДЖ и наличието им дори по главните линии представлява проблем.

Подмяната трябва да се извърши на приоритетен принцип, но колкото може по-бързо.

(Например: Линия №2, Линия №5, Линия №9, Линия №7, Линия №83...)

4) Подмяна на системата за ЦПК

Системата за Централизиран пътен контрол (ЦПК) въведена с цел наблюдение и централизирано определяне на маршрутите в участъка между София и Карлово изпитва недостиг на резервни части поради спирането на производството им в бившия СССР. Тази система не е изградена с модерни електронни устройства и е почти напълно амортизирана.

Линия №3 е една от най-рентабилните линии на БДЖ затова е необходимо подновяване на основата на етапен план.

5) Усъвършенстване и ремонтване на трансмисионните кабелни линии

Има намаление на резервния капацитет на трансмисионните кабели в участъците между София и Г.Оряховица и между София и Карлово.

В края на изпълнението на ППЖ ще бъде възложена Информационна система за управление (MIS).

Затова подновяването и ремонтването на трансмисионните кабели трябва да се извърши чрез подмяна на съществуващите медни кабели с модерни оптични кабели.

(4) Планиране на разходите за поддръжка по години

Таблица 9.2.3-3 План за разходите за поддръжка

(в хил щ.дол)

| Година | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|----------------------------------|-----------------------|----------------|----------------|----------------|----------------|-----------------|----------------|----------------|----------------|----------------|----------------|
| Подвижен състав | Редовен | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 7,800 | 7,800 | 7,800 | 7,800 | 7,800 |
| | Подновяване и подмяна | 22 209 | 22 209 | 22 209 | 22 209 | 22 209 | 36948 | 36948 | 36948 | 36948 | 36948 |
| | Общо | 30 209 | 30 209 | 30 209 | 30 209 | 30 209 | 44748 | 44748 | 44748 | 44748 | 44748 |
| Гражданско строителство | Редовно | 10000 | 10000 | 10000 | 10000 | 10000 | 7000 | 7000 | 7000 | 7000 | 7000 |
| | Подновяване и подмяна | 19900 | 19900 | 19900 | 19900 | 19900 | 19900 | 19900 | 19900 | 19900 | 19900 |
| | Общо | 29900 | 29900 | 29900 | 29900 | 29900 | 26900 | 26900 | 26900 | 26900 | 26900 |
| Електронна лационно строителство | Редовно | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| | Подновяване и подмяна | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 |
| | Общо | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 |
| ОБЩО | | 64074.7 | 64074.7 | 64074.7 | 64074.7 | 64 074.7 | 75613.7 | 75613.7 | 75613.7 | 75613.7 | 75613.7 |

| Година | | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|----------------------------------|-----------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Подвижен състав | Редовен | 7700 | 7700 | 7700 | 7700 | 7700 | 7600 | 7600 | 7600 | 7600 | 7600 |
| | Подновяване и подмяна | 32164 | 32164 | 32164 | 32164 | 32164 | 29809 | 29809 | 29809 | 29809 | 29809 |
| | Общо | 39864 | 39864 | 39864 | 39864 | 39864 | 37409 | 37409 | 37409 | 37409 | 37409 |
| Гражданско строителство | Редовно | 20100 | 20100 | 20100 | 20100 | 20100 | 20100 | 20100 | 20100 | 20100 | 20100 |
| | Подновяване и подмяна | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| | Общо | 22100 | 22100 | 22100 | 22100 | 22100 | 22100 | 22100 | 22100 | 22100 | 22100 |
| Електронна лационно строителство | Редовно | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 | 600 |
| | Подновяване и подмяна | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 | 3365.7 |
| | Общо | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 | 3965.7 |
| ОБЩО | | 65929.7 | 65929.7 | 65929.7 | 65929.7 | 65929.7 | 63474.7 | 63474.7 | 63474.7 | 63474.7 | 63474.7 |

9.2.4 Проекти

1) Безконфликтен комбиниран транспорт

Внедряването на безконфликтен КТ ще се извърши чрез проекта за изграждане на модерни контейнерни товарни гари за развиване на международен товарен комбиниран

транспорт. Понеже за изпълнението на плана необходимите за целта платформи и контейнери ще се наемат, инвестиции в този случай не се предвиждат.

(а) Строителство на товарни гари за контейнерен транзитен транспорт. В зависимост от възможностите на предвидения бюджет препоръчва се изграждане на такива гари във Варна, Русе, Пловдив и др.

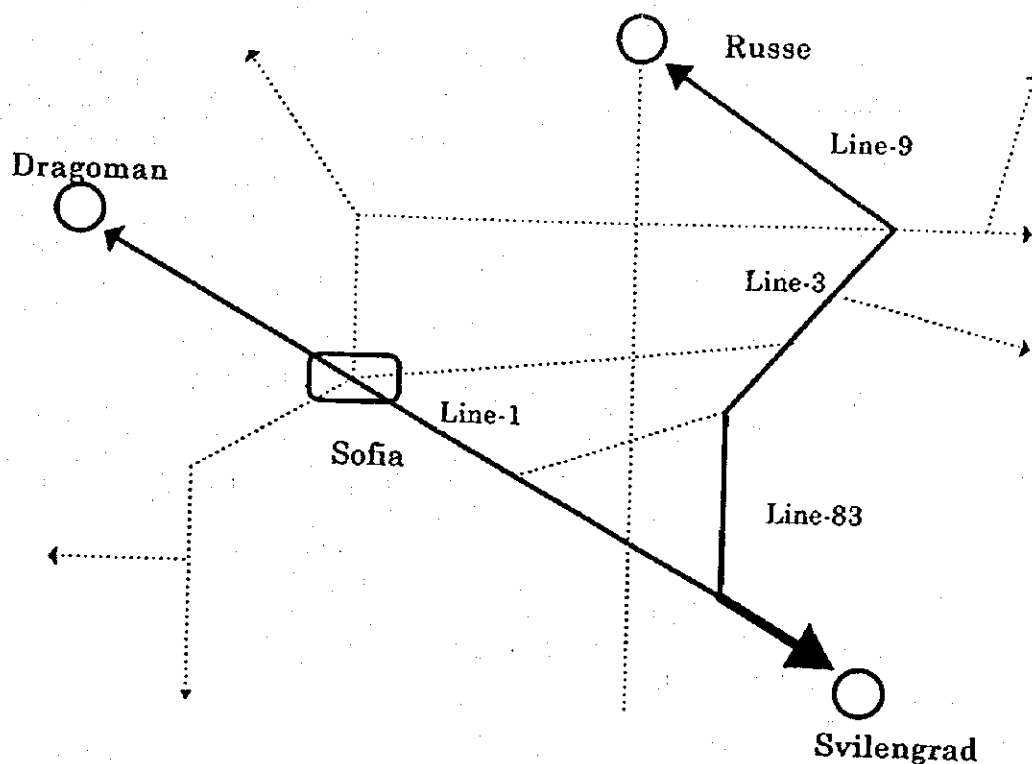
(б) Въвеждане на система за международни товарни превози (система Ro-La), при която товарните влакове могат да превозват ремаркета.

Една от причините за въвеждане на тази система е опазване на околната среда (намаляване на замърсяването на въздуха).

За изграждането на тази система се предлага БДЖ да построи три допълнителни товарни гари за системата Ro-La на гара Драгоман до границата с Югославия, на гара Свиленград до границата с Турция и на гара Русе до границата с Румъния.

Фигурата по-долу показва маршрутите на товарните влакове по тази система.

Маршрути на товарни влакове по системата Ro-La



(2) Други проекти

1) Проект за удвояване на линия №8

Необходимо е да се удвоят някои единични участъци на Линия №8 (с обща дължина 148 км), както следва:

Скутаре-Михайлово (77 км), Калитиново-Безмер (57 км), Ямбол – Зимница (15 км).

Като метод на удвояване на линията се предлага изграждане на нова линия, успоредно на съществуващата.

2) Експеримент за увеличаване на скоростта на движение на влаковете (между София и Пловдив)

След постигане на сегашната цел – скорост от 130 км/час между София и Пловдив, следващата цел за БДЖ е постигане на още по-висока скорост на движение - 160 км/час.

За провеждане на експеримента се избира участък с дължина от 24 км между София и Елпи Пелин.

Необходимите за извършване на експеримента подобрения включват разделяне на жп линия от пътищата на главни кръстовища, закупуване на вагони с наклонящ се кош, подмяна на съществуващите стрелки със стрелки за по-висока скорост и подобрение на електрическите съоръжения.

3) Изграждане на кръстовища на две нива

Разделянето на жп линия и пътища при кръстовищата на Линии № №1, 2, 3 и 8 ще допринесе значително за увеличаване на скоростта на влаковете и безопасността на движение.

4) План за електрификация

За увеличаване на капацитета на международни превози необходимо е да се електрифицира участък с дължина 143 км между Крумово и Свиленград по Линия №1.

5) Изграждане на тунели

Ако се постигне изминаване на пътя между Пловдив и София за един час, двата града ще могат да се развиват балансирано, което ще допринесе също за увеличаване на пътническия транспорт.

За подобряване на участъци с остри криви и стръмни наклони в планинските райони е необходимо да се изградят два тунела.

Като се има предвид размера на необходимите инвестиции, те не трябва да се планират за изпълнение в рамките на Проекта (т.е., това трябва да се извърши след 2020 година).

Побит камък – Чурково (дължина на тунела около 20 км)

Бодрово-Костенец (дължина на тунела около 11 км)

Таблица 9.2.4-1 План за изпълняване на проектите

(В млн. щ. дол.)

| Проект | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | Общо | 2020- | Забележки | | | |
|---|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|-------|-----------|--|-------|-------|
| 1. Модернизация на товарния | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) Товарна гара София | 1.0 | 4.0 | 5.0 | | | | | | | | | | | | | | | | | | | | | Комбиниран бескофликт ен транспорт | | |
| (2) Товарна гара Ro-La | | 8.0 | 19.6 | | | | | | | | | | | | | | | | | | | | | | | |
| Полусбор | 1.0 | 12.0 | 24.6 | | | | | | | | | | | | | | | | | | | | | | 37.6 | |
| 2. Увеличаване на трансп. капацитет | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) Удвояване на пътни | | | | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 298.2 |
| Полусбор | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. Увеличаване на скоростта на движение на влаковете | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.1 София-Пловдив | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) Надлези | | | | | | | | | | | 1.8 | 1.8 | 1.8 | 1.8 | | | | | | | | | | | | 5.4 |
| (2) Подвижен състав | | | | | | | | | | | | | 10.0 | 15.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 25.0 | 75.0 |
| (3) Други съоръжения | | | | | | | | | | | | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 5.0 |
| Полусбор | | | | | | | | | | | 1.8 | 2.8 | 12.8 | 16.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 85.4 |
| 3.2 Други | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) Тунели | | | | | | | | | | | | | | | | | | | | | | | | | | 500 |
| (2) Надлези | | | | | | | | | | | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 45.3 |
| Полусбор | | | | | | | | | | | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 45.3 |
| 4. Електрификация | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (1) Електрификация | | | | | | | | | | | | | 5.0 | 6.0 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 35.9 |
| Полусбор | | | | | | | | | | | | | 5.0 | 6.0 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 8.3 | 35.9 |
| ОБЩО | 1.0 | 12.0 | 24.6 | 0.0 | 0.0 | 42.6 | 42.6 | 42.6 | 42.6 | 42.6 | 47.1 | 48.9 | 12.3 | 23.3 | 28.8 | 38.8 | 38.8 | 38.8 | 4.5 | 4.5 | 4.8 | 4.8 | 4.8 | 4.8 | 502.4 | |

9.2.5 Планове за поддръжка и проекти година по година

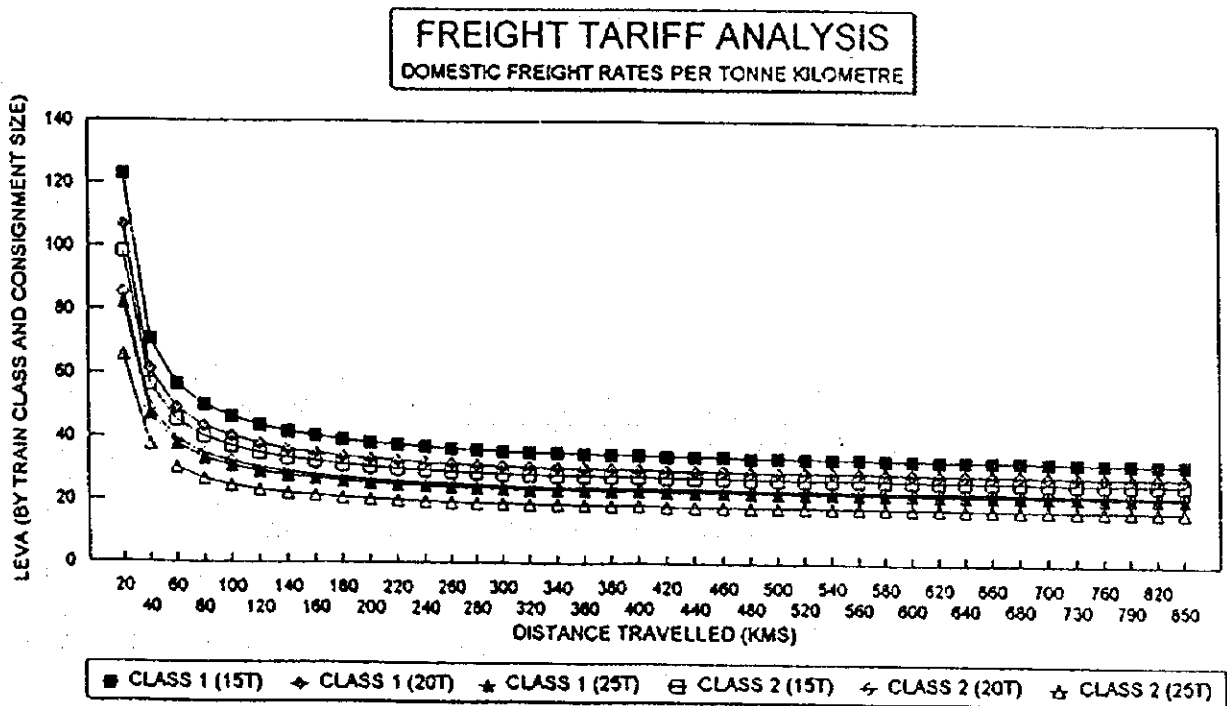
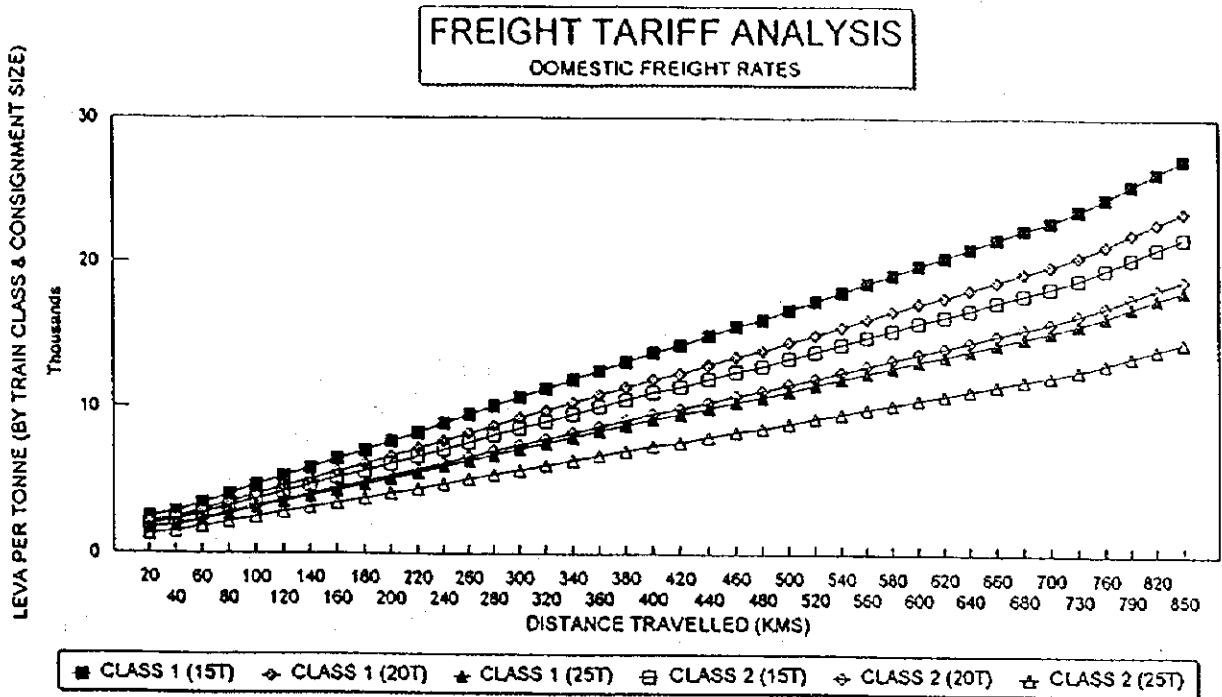
Таблица 9.2.5-1 План за поддръжка и проекти (В млн. дол.)

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | Общо | |
|-----------|---|------------------|------|------|-------|-------|-------|-------|-------|------|------|------|------|---------|-------|
| Поддръжка | Подземна система | 30.2 | 30.2 | 30.2 | 44.7 | 44.7 | 44.7 | 39.9 | 37.4 | 37.4 | 37.4 | 37.4 | 37.4 | 533.8 | |
| | Грунтово строителство | 29.9 | 29.9 | 29.9 | 26.9 | 26.9 | 22.1 | 22.1 | 22.1 | 22.1 | 22.1 | 22.1 | 22.1 | 308.0 | |
| | Електрификация | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 44.0 | |
| | Общо | 64.1 | 64.1 | 64.1 | 75.6 | 75.6 | 70.8 | 66.0 | 66.0 | 63.5 | 63.5 | 63.5 | 63.5 | 1,018.8 | |
| Проекти | Модернизация на токовите линии | 1.0 | 12.0 | 24.6 | | | | | | | | | | 37.6 | |
| | Увеличаване на пропусковите способности | | | | 42.6 | 42.6 | 42.6 | 42.6 | | | | | | 170.4 | |
| | Усилване на скоростта на движение | Секции/Платформи | | | | 1.8 | 2.8 | 12.8 | 16.0 | 26.0 | | | | | 59.4 |
| | | Други | | | | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 4.5 | 54.0 |
| | Електрификация | | | | | 5.0 | 6.0 | 8.3 | 8.3 | 8.3 | | | | | 35.9 |
| | Полубри | 1.0 | 12.0 | 24.6 | 0.0 | 42.6 | 47.1 | 48.9 | 28.8 | 38.8 | 4.5 | 4.5 | 4.5 | 4.5 | 202.4 |
| Общо | 65.1 | 76.1 | 88.7 | 64.1 | 118.2 | 117.9 | 114.0 | 104.8 | 102.3 | 68.0 | 68.0 | 68.0 | 68.0 | 1,041.2 | |

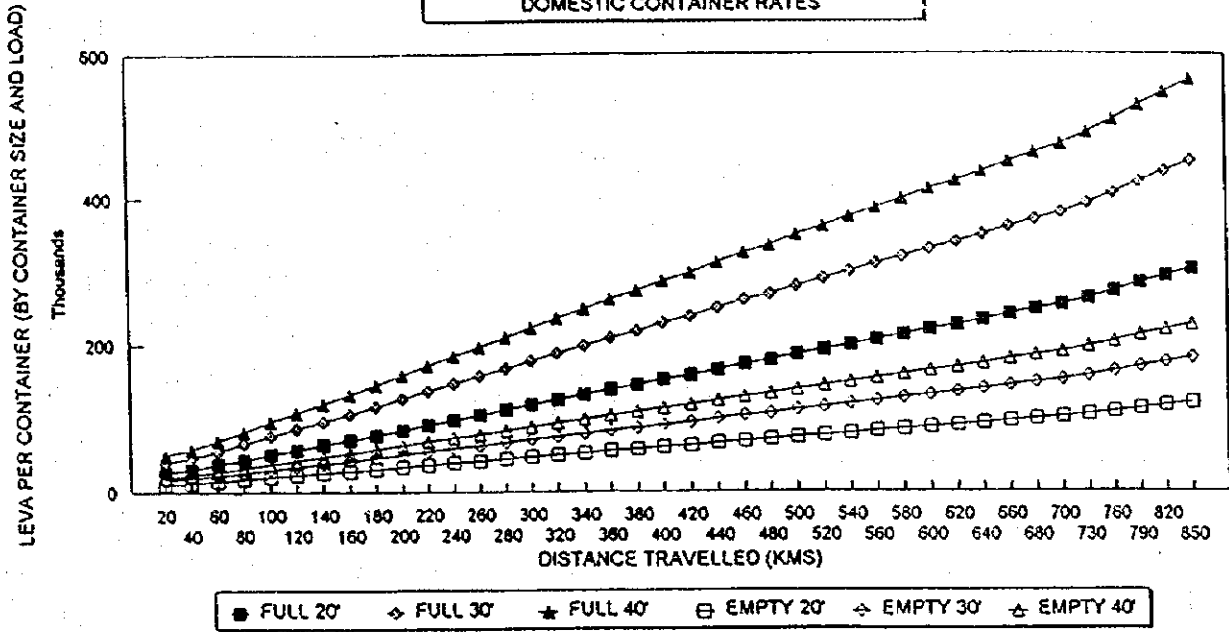
ДОПЪЛНЕНИЕ

I. APPENDIX FOR TARIFF POLICY OF CHAPTER 7.2

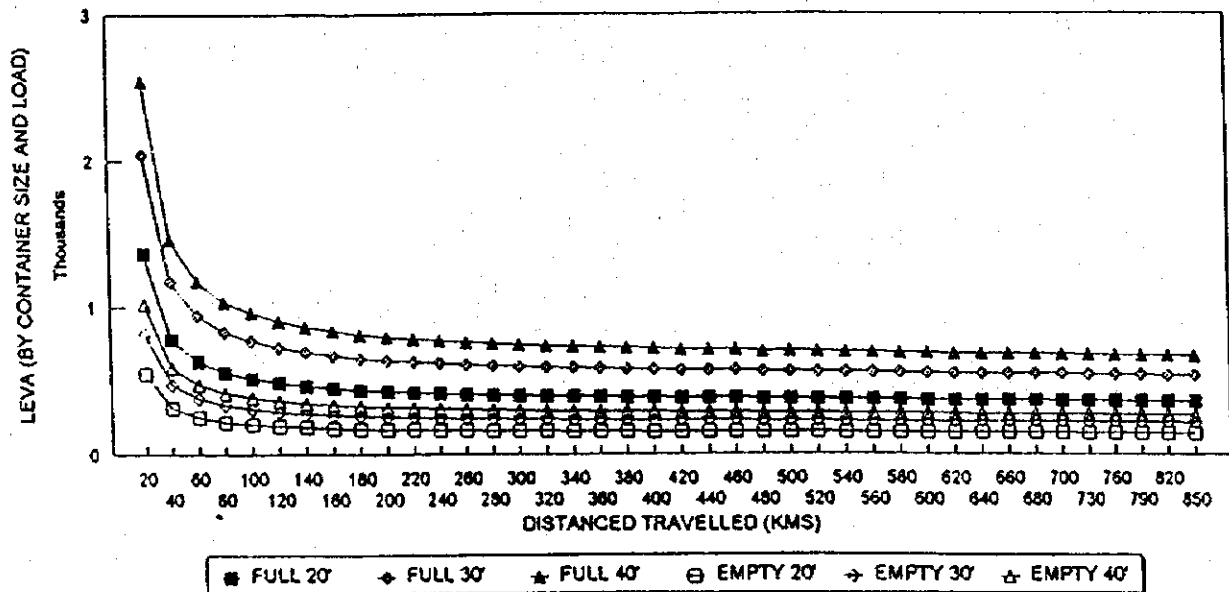
I.1 GRAPHICAL ANALYSIS OF TARIFFS



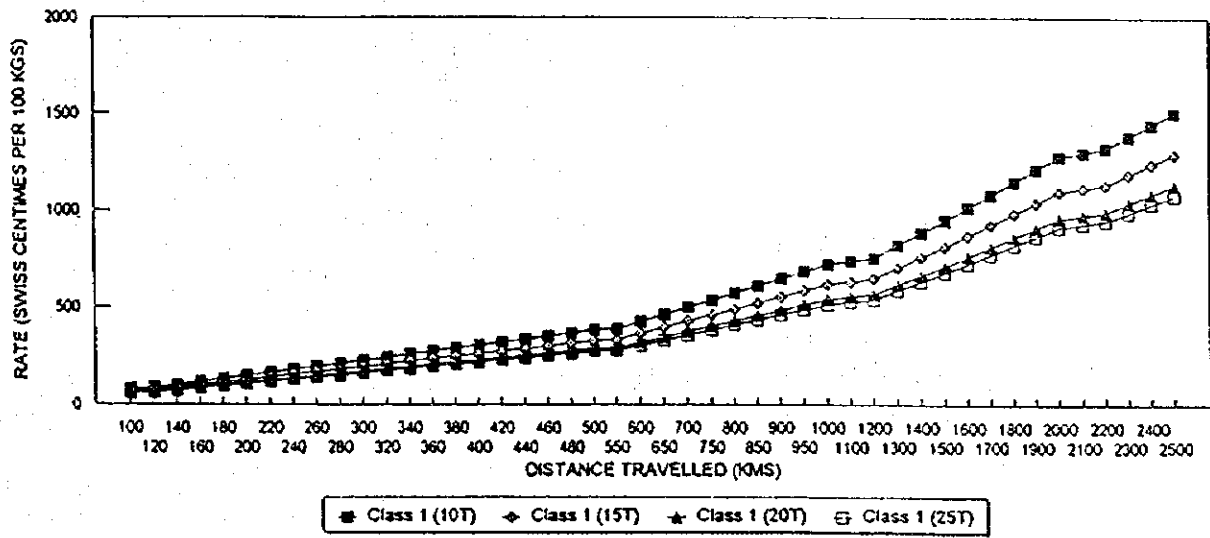
FREIGHT TARIFF ANALYSIS DOMESTIC CONTAINER RATES



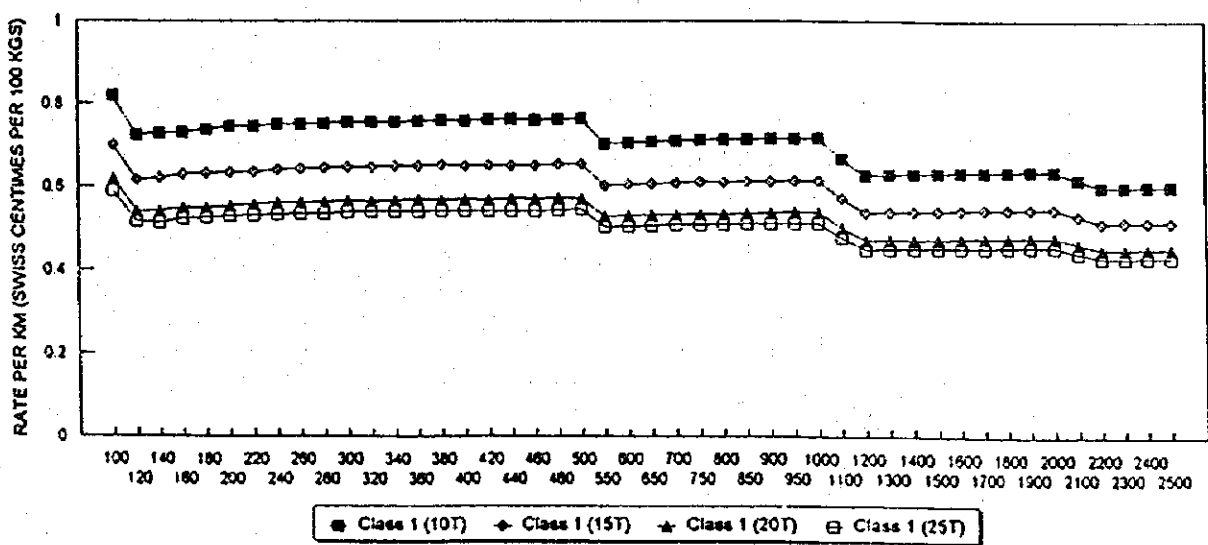
FREIGHT TARIFF ANALYSIS DOMESTIC CONTAINER RATE PER KILOMETRE



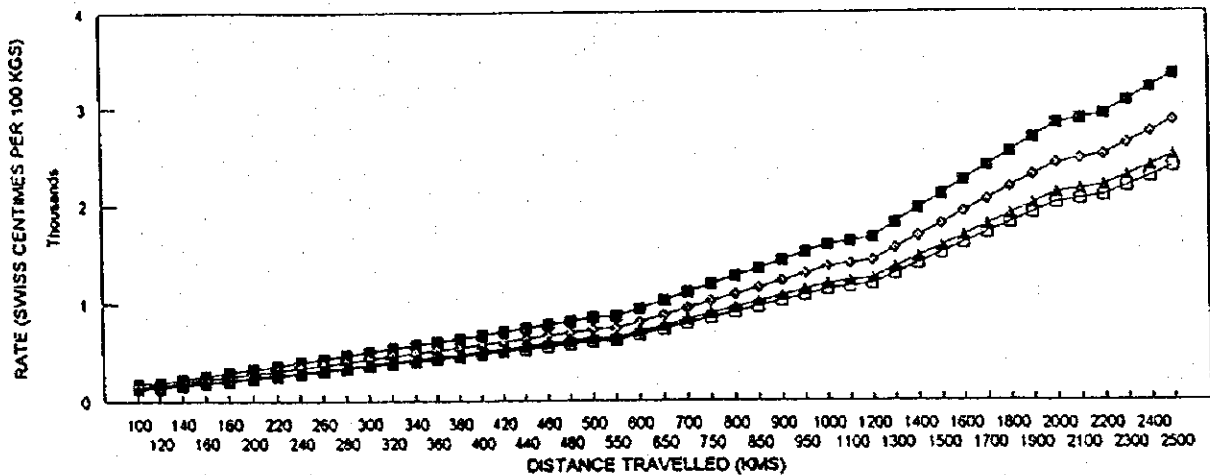
FREIGHT TARIFF ANALYSIS
WAGONLOAD SHIPMENTS OF IMPORT & EXPORTS



FREIGHT TARIFF ANALYSIS
WAGONLOAD SHIPMENTS OF IMPORT & EXPORTS

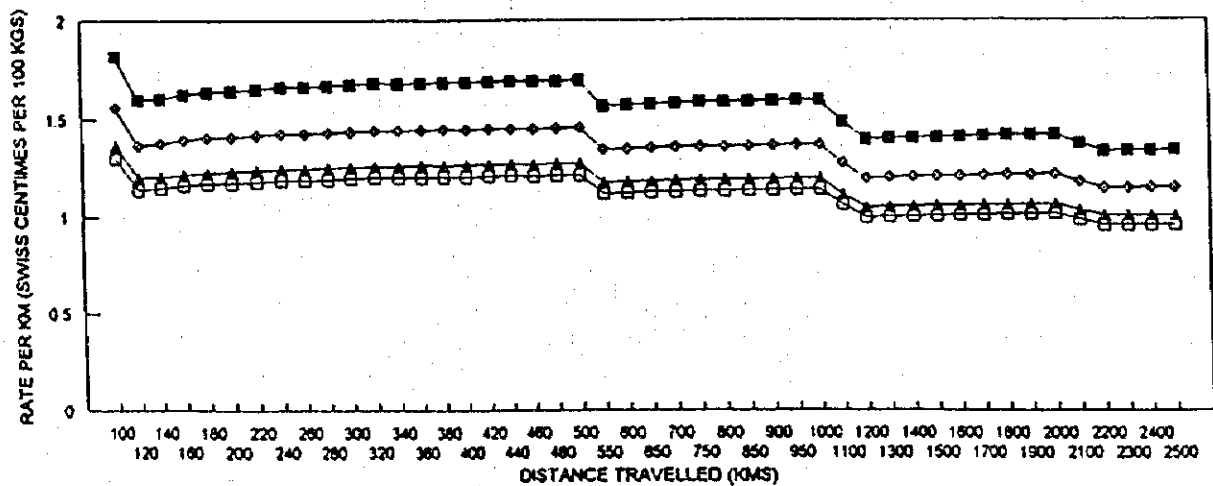


FREIGHT TARIFF ANALYSIS
WAGONLOAD SHIPMENTS OF TRANSIT TRAFFIC



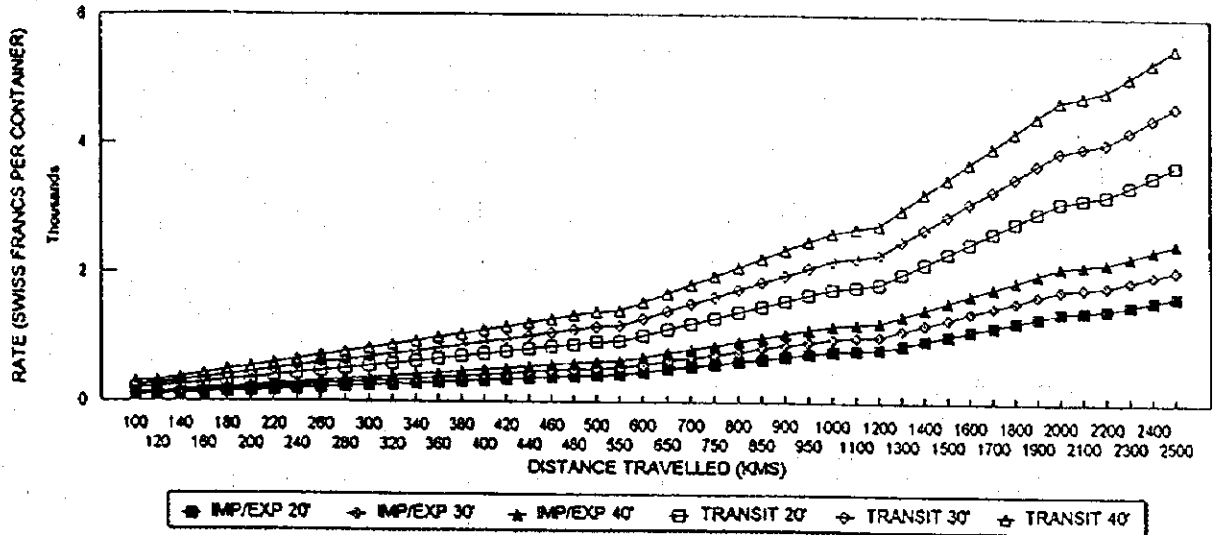
■ Class 1 (10T) ◆ Class 1 (15T) ▲ Class 1 (20T) □ Class 1 (25T)

FREIGHT TARIFF ANALYSIS
WAGONLOAD SHIPMENTS OF TRANSIT TRAFFIC

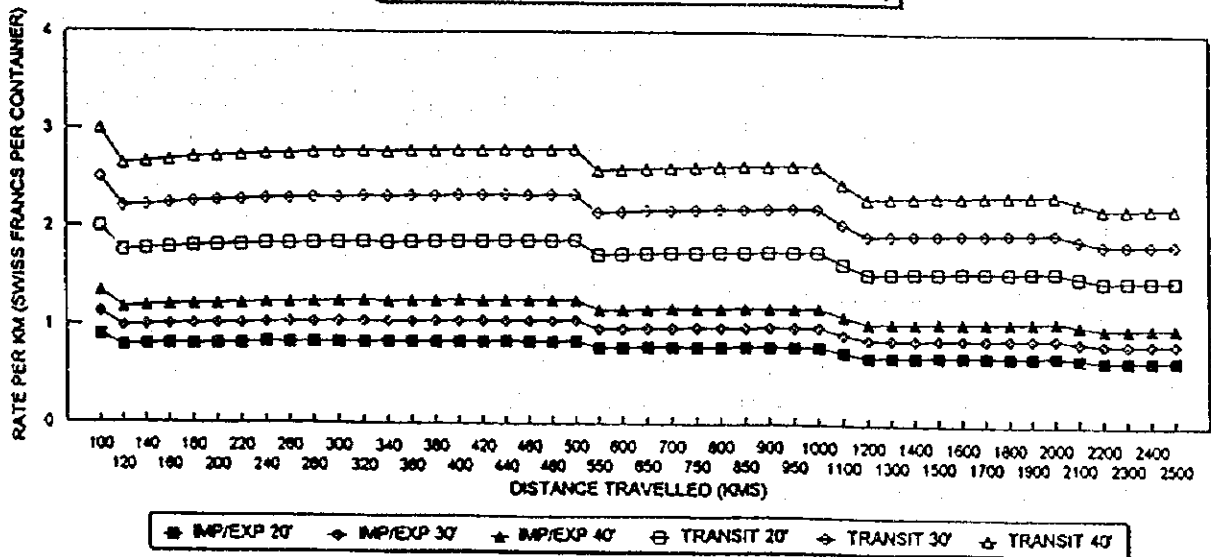


■ Class 1 (10T) ◆ Class 1 (15T) ▲ Class 1 (20T) □ Class 1 (25T)

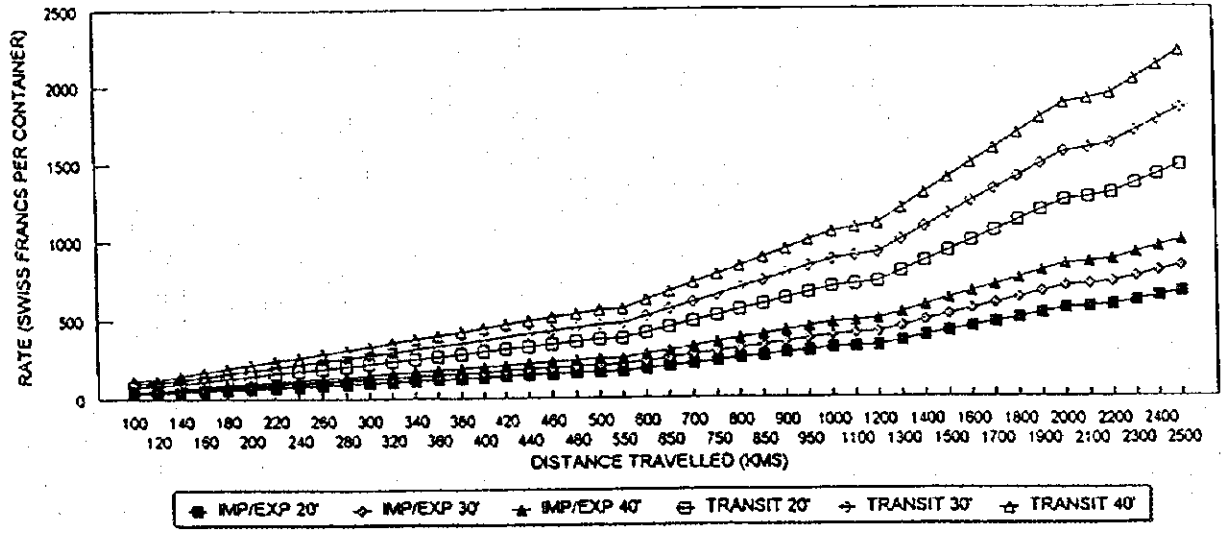
FREIGHT TARIFF ANALYSIS
 LOADED CONTAINER TRAFFIC (TRANSIT & IMPORT/EXPORT)



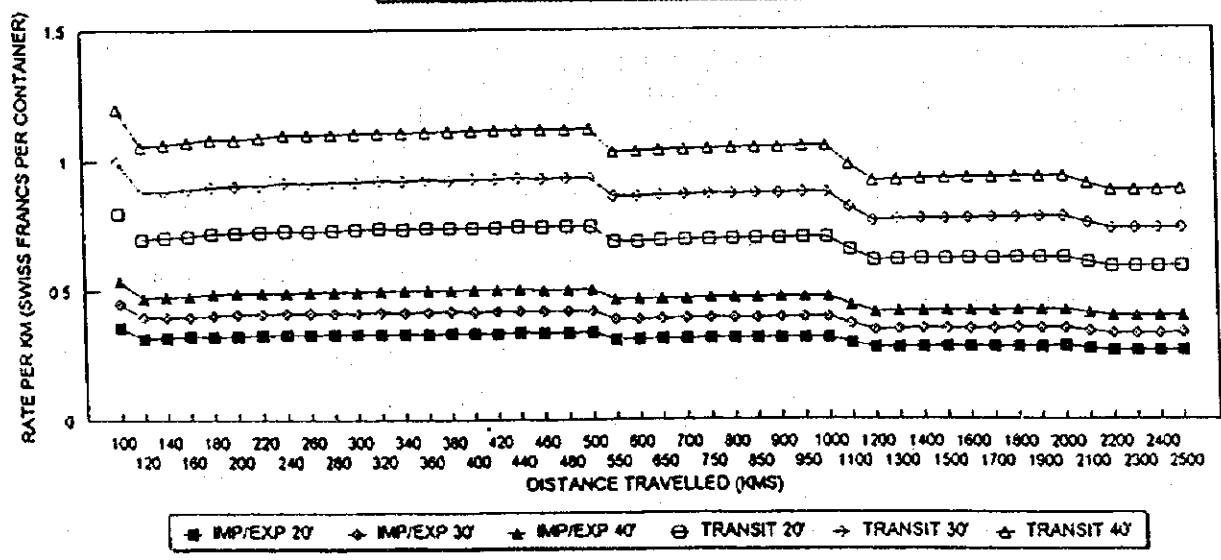
FREIGHT TARIFF ANALYSIS
 FULL CONTAINER TRAFFIC (TRANSIT & IMPORT/EXPORT)



FREIGHT TARIFF ANALYSIS
EMPTY CONTAINER TRAFFIC (TRANSIT & IMPORT/EXPORT)



FREIGHT TARIFF ANALYSIS
EMPTY CONTAINER TRAFFIC (TRANSIT & IMPORT/EXPORT)



1.2 BDZ ON TRAIN SURVEY SEPTEMBER 1997

Introduction

An on train survey was organised at the end of September 1997 to research specific aspects of the passenger market, in particular the responsiveness of passengers to changes in price and journey time. It was decided to concentrate mainly of BDZ's fast train services on the principal east-west routes that are the main source of passenger revenue. Separate questions relating to the impact of price changes had also been included as part of the environmental survey of households in rural areas.

The chosen trains were :-

Route One Sofia - Gomo Oriahovitsa & Return : Train 411 & Train 210

Route Two Sofia - Tulovo & Return : Train 321 & Train 310

Route Three Sofia - Plovdiv & Return : Train 120, Train 121, & Train 812

Surveys took place on Tuesday, Wednesday, and Thursday (23-25th September), avoiding any differences that would affect the results due to the calendar (weekend) fares that apply on various trains on Mondays and Fridays.

Questionnaires were distributed at random amongst passengers twice during each journey. The first was close to Sofia and the second at some distance away to include passengers who joined the train on route. The procedure was mirrored on the return journey into Sofia.

The questionnaire was developed in liaison with BDZ's Passenger Department and translated in Bulgarian. Copies can be found at the end of this Appendix. A sample size of about 500-600 was sought. The response rate, however, was much better than expected. Of the 964 questionnaires distributed 954 (99%) were returned. 661 were coded for analysis split roughly by the three routes (Route One : 212, Route Two : 215, & Route Three : 234). This gave a representative sample of BDZ's passengers using fast train services. The results of the analysis is described below, with the tables of results at the end of this Appendix.

BDZ ON TRAIN SURVEY

Dear Customer

Bulgarian State Railways (BDZ) is conducting a study of their passenger train services. I would be grateful if you would assist us by spending a few minutes to complete the following questionnaire.

Yours sincerely

For Director General BDZ

- Q1. At which BDZ station did you board this train? Station Name
- Q2. How did you get to the BDZ station? (Tick One Box)
- | | | | | | |
|---------------------------------|--------------------------|---------------------|--------------------------|--------------|--------------------------|
| 1. Walked all the way | <input type="checkbox"/> | 2. Bus/Coach | <input type="checkbox"/> | 3. Taxi | <input type="checkbox"/> |
| 4. Motorcycle/Bicycle | <input type="checkbox"/> | 5. Passenger in car | <input type="checkbox"/> | 6. Drove car | <input type="checkbox"/> |
| 7. Other (Please explain) | | | | | |
- Q3. At which BDZ station will you finish this journey? Station Name
- Q4. How will you get to your final destination on leaving this train? (Tick One Box)
- | | | | | | |
|---------------------------------|--------------------------|---------------------|--------------------------|--------------|--------------------------|
| 1. Walked all the way | <input type="checkbox"/> | 2. Bus/Coach | <input type="checkbox"/> | 3. Taxi | <input type="checkbox"/> |
| 4. Motorcycle/Bicycle | <input type="checkbox"/> | 5. Passenger in car | <input type="checkbox"/> | 6. Drove car | <input type="checkbox"/> |
| 7. Other (Please explain) | | | | | |
- Q5. What is the main purpose of your journey (Tick One Box)
- | | | | |
|----------------------------------|--------------------------|------------------------------|--------------------------|
| 1. To or from work place | <input type="checkbox"/> | 2. On employers business | <input type="checkbox"/> |
| 3. Visiting friends or relatives | <input type="checkbox"/> | 4. Shopping | <input type="checkbox"/> |
| 5. On Holiday | <input type="checkbox"/> | 6. To or from school/college | <input type="checkbox"/> |
| 7. Other (Please specify) | | | |
- Q6. How often do you make the rail journey you are now on? (Tick One Box)
- | | | | | | |
|-------------------------|--------------------------|---|--------------------------|----------------------|--------------------------|
| 1. Several times a week | <input type="checkbox"/> | 2. Once a week | <input type="checkbox"/> | 3. 2-3 times a month | <input type="checkbox"/> |
| 4. Once a month | <input type="checkbox"/> | 5. Less frequent (number of times a year) | | | |
- Q7. Is this the outward or return part of your journey? (Tick One Box)
- | | | | |
|------------|--------------------------|-----------|--------------------------|
| 1. Outward | <input type="checkbox"/> | 2. Return | <input type="checkbox"/> |
|------------|--------------------------|-----------|--------------------------|
- Q8. What type of train are you travelling on? (Tick One Box)
- | | | | | | |
|------------|--------------------------|---------|--------------------------|-----------|--------------------------|
| 1. Express | <input type="checkbox"/> | 2. Fast | <input type="checkbox"/> | 3. Normal | <input type="checkbox"/> |
|------------|--------------------------|---------|--------------------------|-----------|--------------------------|
- Q9. Are you travelling first or second class? (Tick One Box)
- | | | | |
|----------|--------------------------|-----------|--------------------------|
| 1. First | <input type="checkbox"/> | 2. Second | <input type="checkbox"/> |
|----------|--------------------------|-----------|--------------------------|
- Q10. What was the main reason for choosing to travel by train rather than by other modes of transport? (Tick One Box)
- | | | | |
|---------------------------------------|--------------------------|--|--------------------------|
| 1. Shorter journey time by train | <input type="checkbox"/> | 2. Safer by rail | <input type="checkbox"/> |
| 3. No alternative transport available | <input type="checkbox"/> | 4. Cheapest mode of transport | <input type="checkbox"/> |
| 5. More comfortable | <input type="checkbox"/> | 6. More frequent or convenient service | <input type="checkbox"/> |
| 7. Other (Please state) | | | |
- Q11. What type of ticket do you have? (Tick One Box)
- | | | | | | |
|--------------------------------|--------------------------|------------------|--------------------------|---------------------|--------------------------|
| 1. Single fare | <input type="checkbox"/> | 2. Return fare | <input type="checkbox"/> | 3. Student single | <input type="checkbox"/> |
| 4. Pensioner single | <input type="checkbox"/> | 5. Forces single | <input type="checkbox"/> | 6. One Month Season | <input type="checkbox"/> |
| 7. Three Month Season | <input type="checkbox"/> | 8. Free Ticket | <input type="checkbox"/> | 9. BDZ Staff Pass | <input type="checkbox"/> |
| 10. Other (Please state) | | | | | |

- Q12. How did you pay for your ticket? (Tick One Box)**
1. Paid for by employer 2. Paid by educational organisation
 3. Paid by family member 4. Paid by own money
 5. Other (Please state)
- Q13. What is the price of your ticket?Leva**
- Q14. What level of fares increase would make you stop using BDZ's train service for your current journey (ONLY Tick One Box)**
- | | | |
|---|---|---|
| 50 - 100 Leva <input type="checkbox"/> | 101 - 200 Leva <input type="checkbox"/> | 201 - 300 Leva <input type="checkbox"/> |
| 301 - 400 Leva <input type="checkbox"/> | 401 - 600 Leva <input type="checkbox"/> | 601 - 800 Leva <input type="checkbox"/> |
| 801 - 1000 Leva <input type="checkbox"/> | 1001 - 1200 Leva <input type="checkbox"/> | 1201 - 1400 Leva <input type="checkbox"/> |
| 1401 - 1600 Leva <input type="checkbox"/> | 1601 - 1800 Leva <input type="checkbox"/> | 1801 - 2000 Leva <input type="checkbox"/> |
| 2001 - 2500 Leva <input type="checkbox"/> | 2501 - 3000 Leva <input type="checkbox"/> | 3001 - 4000 Leva <input type="checkbox"/> |
- More that 4000 Leva If so, how many Leva
- Q15. If the fare was more than you were prepared to pay what would you do instead? (Tick One Box)**
1. Travel to same destination by bus 2. Travel to same destination by car
 3. Travel to same destination by air 4. Travel to an alternative destination
 5. Not travel at all 6. Other (Please state)
- Q16. How long is your current train journey from start to finish?**
- Hours & Minutes
- Q17. Which of the following time savings would cause you to make the same journey by rail more often? (ONLY Tick One Box)**
- | | | |
|--|--|--|
| 10 -20 Minutes <input type="checkbox"/> | 20 - 30 Minutes <input type="checkbox"/> | 31 - 40 Minutes <input type="checkbox"/> |
| 41 - 50 Minutes <input type="checkbox"/> | 51 - 60 Minutes <input type="checkbox"/> | 1 - 1¼ Hours <input type="checkbox"/> |
| 1¼ - 1½ Hours <input type="checkbox"/> | 1½ - 1¾ Hours <input type="checkbox"/> | 1¾ - 2 Hours <input type="checkbox"/> |
| 2 - 2½ Hours <input type="checkbox"/> | 2½ - 3 Hours <input type="checkbox"/> | 3 - 3½ Hours <input type="checkbox"/> |
- 3 - 4 Hours More than 4 Hours If so, how many Hours
- Q18. How many additional return journeys per year would you then make?**
- journeys
- Q19. Which age group do you belong? (Tick One Box)**
- | | | |
|--|---|--|
| 1. Under 15 years <input type="checkbox"/> | 2. 15-19 years <input type="checkbox"/> | 3. 20-24 years <input type="checkbox"/> |
| 4. 25-29 years <input type="checkbox"/> | 5. 30-39 years <input type="checkbox"/> | 6. 40-49 years <input type="checkbox"/> |
| 7. 50-59 years <input type="checkbox"/> | 8. 60-69 years <input type="checkbox"/> | 9. 70 years or more <input type="checkbox"/> |
- Q20. Which gender are you? (Tick One Box)**
1. Male Female
- Q21. What is your occupation? (Tick One Box)**
- | | | |
|--|--|---|
| 1. Employed <input type="checkbox"/> | 4. Self Employed <input type="checkbox"/> | 7. Student/scholar <input type="checkbox"/> |
| 2. House person <input type="checkbox"/> | 5. Retired <input type="checkbox"/> | 8. Armed forces <input type="checkbox"/> |
| 3. Farmer <input type="checkbox"/> | 6. Unemployed/not working <input type="checkbox"/> | |
9. Other (Please describe)
- Q22. If employed or self employed, what is your approximate monthly income? (Optional question)**
- Leva

THANK YOU VERY MUCH FOR YOUR ASSISTANCE

АНКЕТА ВЪВ ВЛАКОВТЕ НА БДЖ

Уважаеми пътници,

Бълг. държавни железници извършват проучване на пътническите влакови услуги. Ще Ви бъдем много благодарни, ако отделите време, за да попълните тази анкета.

С уважение: _____

Зам. генерален директор на БДЖ

В 1: На коя ж.п. гара се качихте на влака?

Ж.п. гара:

В 2: Как се придвижихте до ж.п. гарата? (Моля отбележете само един отговор)

- | | | | | | |
|---------------------------|-----|-------------------------------|-----|------------|-----|
| 1. Изцяло пеша | [] | 2. С автобус | [] | 3. С такси | [] |
| 4. С мотоциклет/велосипед | [] | 5. Като пътник в автомобил | [] | | |
| 6. С личен автомобил | [] | 7. Друго (Моля посочете)..... | | | |

В 3: До коя ж.п. гара пътувате?

Ж.п. гара:

В 4: Как ще се придвижите до крайната точка на Вашето пътуване, след като слезете от влака? (Моля отбележете само един отговор)

- | | | | | | |
|-------------------------|-----|---------------------------------------|-----|------------|-----|
| 1. Пеша | [] | 2. С автобус | [] | 3. С такси | [] |
| 4. Мотоциклет/велосипед | [] | 5. Като пътник в автомобил | [] | | |
| 6. С личен автомобил | [] | 7. Друго (Моля посочете с какво)..... | | | |

В 5: Каква е основната цел на Вашето пътуване? (Моля отбележете само един отговор)

- | | | | | | |
|-------------------------------------|-----|-------------------------------|-----|------------|-----|
| 1. До или от работното място | [] | 2. Командировка | [] | | |
| 3. Посещение на близки или приятели | [] | 4. Пазар | [] | 5. Почивка | [] |
| 6. До или от училище | [] | 7. Други (Моля обяснете)..... | | | |

В 6: Колко често пътувате с влак по този маршрут? (Моля отбележете само един отговор)

- | | | | | | |
|--------------------------|-----|---------------------------------------|-----|---------------------|-----|
| 1. Няколко пъти седмично | [] | 2. Веднъж седмично | [] | 3. 2-3 пъти месечно | [] |
| 4. Веднъж месечно | [] | 5. По-рядко (колко пъти годишно)..... | | | |

В 7: Това пътуване отиване или завръщане от мястото на посещение ли е? (Моля отбележете само един отговор)

- | | | | |
|------------|-----|------------|-----|
| 1. Отиване | [] | 2. Връщане | [] |
|------------|-----|------------|-----|

В 8: С какъв вид влак пътувате? (Моля отбележете само един отговор)

- | | | | | | |
|--------------|-----|---------|-----|---------------|-----|
| 1. Експресен | [] | 2. Бърз | [] | 3. Пътнически | [] |
|--------------|-----|---------|-----|---------------|-----|

В 9: Вие пътувате в първа или втора класа? (Моля отбележете само един отговор)

- | | | | |
|----------|-----|----------|-----|
| 1. Първа | [] | 2. Втора | [] |
|----------|-----|----------|-----|

В 10: Каква е причината да изберете да пътувате с влак вместо с друг вид транспорт? (Моля отбележете само един отговор)

- | | | | |
|--------------------------------------|-----|---------------------------------------|-----|
| 1. По-късо времетраене на пътуването | [] | 2. По-безопасно е | [] |
| 3. Поради липса на друга алтернатива | [] | 4. Най-евтино е | [] |
| 5. По-удобно е | [] | 6. Връзките са по-чести или по-удобни | [] |
- Друга (Моля обяснете).....

В 11: С какъв вид билет пътувате? (Моля отбележете само един отговор)

- | | | | |
|---------------------------------|-----|----------------------------------|-----|
| 1. Еднопосочен | [] | 2. Двупосочен | [] |
| 3. Еднопосочен за учачи | [] | 4. Еднопосочен за възрастни | [] |
| 5. Военен еднопосочен | [] | 6. Едномесечна абонаментна карта | [] |
| 7. Тримесечна абонаментна карта | [] | 8. Безплатен | [] |
| 9. Билет на служител на БДЖ | [] | | |
| 10. Друг (Моля посочете)..... | | | |

В 12. Кой заплати билета Ви? (Моля отбележете само един отговор)

- | | | | |
|-------------------------|-----|-------------------------------|-----|
| 1. Работодателят | [] | 2. Образователната институция | [] |
| 3. Член от семейството | [] | 4. Със собствени средства | [] |
| 5. Друг (Моля обяснете) | [] | | |

В 13: Каква е цената на билета Ви?Лева

В 14: Какво повишение на цените ще Ви принуди да се откажете да използвате влаковете на БДЖ за вашето сегашно пътуване? (Моля отбележете само един отговор)

- | | | | | | |
|--------------|-----|------------------------|-------|--------------|-----|
| 50-100 лв | [] | 101-200 лв | [] | 201-300 лв | [] |
| 301-400 лв | [] | 401-600 лв | [] | 601-800 лв | [] |
| 801-1000 лв | [] | 1001-1200 лв | [] | 1201-1400 лв | [] |
| 1401-1600 лв | [] | 1601-1800 лв | [] | 1801-2000 лв | [] |
| 2001-2500 лв | [] | 2501-3000 лв | [] | 3001-4000 лв | [] |
| Над 4000 лв. | | Ако е така, колко лева | | | |

В 15: Какво бихте направили ако цената на билета е по-висока от тази, която сте се приготвили да платите? (Моля отбележете само един отговор)

- | | | | |
|--|-----|---|-----|
| 1. Бих пътувал/а с автобус до същото местоназначение | [] | 2. Бих пътувал/а с кола до същото местоназначение | [] |
| 3. Бих пътувал/а със самолет | [] | 4. Бих пътувал/а до друго възможно място | [] |
| 5. Не бих пътувал/а изобщо | [] | 6. Друго (Моля обяснете) | [] |

В 16: Каква е продължителността на сегашното Ви пътуване от началната до крайната Ви гара? Часове Минути

В 17: Ще пътувате ли по-често по този маршрут с влак, ако времето за пътуване се съкрати с: (Моля отбележете само един отговор)

- | | | | | | |
|--------------------|-----|--|-----|----------------|-----|
| 10-20 мин. | [] | 20-30 мин. | [] | 31-40 мин. | [] |
| 41-50 мин. | [] | 51-60 мин. | [] | 1 - 1 1/4 часа | [] |
| 1 1/4 - 1 1/2 часа | [] | 1 1/2 - 1 3/4 часа | [] | 1 3/4 - 2 часа | [] |
| 2 - 2 1/2 часа | [] | 2 1/2 - 3 часа | [] | 3 - 3 1/2 часа | [] |
| 3-4 часа | [] | Повече от 4 часа. Ако е така, колко часа повече..... | | | |

В 18: Като имате предвид горепосочения отговор, колко още двупосочни пътувания бихте направили годишно по този маршрут?

..... пътувания

В 19: В коя от следните възрастови групи попадате?

- | | | | | | |
|-------------|-----|------------|-----|-------------|-----|
| 1. под 15г. | [] | 2. 15-19г. | [] | 3. 20-24г. | [] |
| 4. 5-29г. | [] | 5. 30-39г. | [] | 6. 40-49г. | [] |
| 7. 50-59г. | [] | 8. 60-69г. | [] | 9. Над 70г. | [] |

В 20: От какъв пол сте?

- | | | | |
|----------|-----|-----------|-----|
| 1. Мъжки | [] | 2. Женски | [] |
|----------|-----|-----------|-----|

В 21: С какво се занимавате?

- | | | | | | |
|-----------------|-----|-------------------------|-----|-------------------|-----|
| 1. Работа | [] | 4. На свободна практика | [] | 7. Ученик/студент | [] |
| 2. Домакия | [] | 5. Пенсиониран | [] | 8. Военнослужещ | [] |
| 3. Земеделец | [] | 6. Безработен/неработещ | [] | 9. Друг..... | [] |
| (Моля обяснете) | | | | | |

В 22: Ако работите или сте на свободна практика, какъв е приблизително Вашият месечен доход? (Моля отговорете само ако желаете)

Много Ви благодарим за помощта!

Results of Analysis

Q1 & Q3. Boarding & Alighting Stations

It was notable that a large number of both boarding and alighting stations were represented (39 and 61 respectively). There was only a few that were major origin and/or destination stations. Sofia was the most significant source and destination of traffic. The number of stations included indicates that the origin/destination pattern of BDZ passenger network is complex. It also indicates that the sample analysed is not dominated by a few important traffic flows.

Q2 & Q4. Access & Egress Modes of Transport

Access and egress to/from the station is clearly dominated either by walking or by bus (70-80% of the responses). Bus is by far the most dominant mode. This is not surprising in Bulgaria with a low car ownership. Tram is also an important means of access to/from Sofia Central Station. BDZ, therefore, relies on other public transport operators to get passengers to/from the stations.

Q5. Journey Purpose

A range of journey purposes were included, with no single one dominating. The most significant one (at 30% of the total) was visiting friends and relatives. The next was on employers business, indicating the importance of business traffic (first and second class) to BDZ. As the trains were principally the fast inter-city services only 10% were travelling to/from work. It is to be expected that these proportions will vary significantly on Fridays and weekends with a considerably larger volume of leisure traffic.

Q6. Journey Frequency

From the responses there would appear to be three main types of passengers - those who travel frequently (possibly everyday if they are commuters); those who travel regularly once, or a few times a month; and occasional travellers who only travel once or twice a year. This indicates three difference sections of the overall travel market.

Q7. Outward or Return Journey

This was divided almost exactly into two thirds of passengers making outbound journeys and one third making return journeys.

Q8. Train Type

As to be expected this was dominated by fast trains. A proportion of the passengers were also sampled on Train 812 that is designated as an Express Train by BDZ.

Q9. Carriage Class

This is divided roughly into 20% first class and 80% second class. Whilst the second class predominates, the first class market is clearly also important for BDZ. This result corresponds with the importance of business traffic commented on in question five.

Q10. Reasons for Choosing to Travel By Train

This is dominated by two main reasons - either passengers have no other transport available or that rail is the cheapest mode. These do not represent positive reasons for choosing to use rail. As cheapness of travel is the most important it is clear that passengers will be sensitive to the movement of train fares relative to bus fares.

Q11. Ticket Type

The vast majority of tickets sold were single fares, comprising about 66% of the total. The largest individual group sold were student single tickets. Only a small proportion were season tickets. A significant proportion however (15.6%) were passengers travelling free, either with a free tickets or using a BDZ staff pass.

Q12. Ticket Payment

Payment is predominantly made from household income, either by the person buying the ticket or by someone from their family. The other major source is from the employer paying for business travel.

Q13. Ticket Price

A large range of ticket prices were included reflecting the complex pattern of traffic movements commented on in questions one and three. The vast majority of journeys are in the price range of 500 - 3000 Leva.

Q14. Fares Elasticities (Fares Increase Causing Passenger to Cease Using BDZ)

Question 14 was used in combination with questions 6 and 13 to derive fares elasticities that reflect the way passengers respond to increases in fares. Not all passengers are willing to pay additional fares when tariffs increase and stop using the train service. The revenue that BDZ will receive relates to how sensitive passengers are to fares increases. The form of the calculation of a fares elasticity is :-

$$\% \text{Change in demand} \div \% \text{ change in fare}$$

A fares elasticity greater than 1.0 (called 'elastic') shows that passengers will respond highly to fares increases and BDZ will lose money by a general price increase as passenger numbers would go down more. The closer the elasticity is to zero the less sensitive passengers are to fares increases (called 'inelastic') and BDZ will gain more revenue than the loss of passengers. The total passenger market will be made up of groups who will have different fares elasticities.

It was possible to derive elasticities for the whole of the first and second class markets. In addition it was also possible to derive separate second class elasticities for second class passengers along all three routes (Northern Route via Gorno Oriahovitsa, Central Route via Tulovo, Southern Route via Plovdiv). The response to this question was lower than for most of the others. It was not possible therefore to obtain a large enough sample size to divide the first class market by routes.

With an elasticity of -1.54 it shows that first class passengers are sensitive to fares increase more than second class (-0.81). The result for the first class market, however may be influenced by the small sample size (32) and the response of a small number of commuters who make a large proportion of the total number of first class journeys.

The separate elasticities for second class passengers on the three routes indicate that they will respond differently to a fares increase. The Northern Route (-0.56) is the most inelastic whereas the Southern Route has an elasticity of exactly -1.00. This indicates that fares increases should not be uniform throughout the system but should be selective by route and by separate market segments.

Q15. Alternative Arrangements if Fares Increase Too Much

The two most important alternatives are that passengers will travel by bus or not travel at all. The second implies that passengers are dependent on rail and their socio-economic activities will be curtailed if train fares are increased too much, implying social hardship. Travel by car is an option for a proportion of passengers, most likely by taxi. The level of uncoded responses implies that a significant number of passengers do not know what response would be.

Q16. Journey Time

A very significant range of responses is included. This again supports the complex pattern of traffic movements made on BDZ. With an average journey length of 234 minutes the majority of passengers are travelling inter-city rather than making local journeys.

Q17 & Q18. Journey Time Elasticities (Additional Trips)

This is similar to question 14 above except that it seeks to quantify the responsiveness of passengers to journey time changes. It was achieved by combining the answers with questions 6 and 16. The form of the calculation of a journey time elasticity is :-

$$\% \text{Change in demand} \div \% \text{ change in journey time}$$

As to be expected first class passengers have the highest elasticity and are the most sensitive to journey time changes. Whilst the elasticity, at -0.97, is less than unity it only measures those people who actually use first class. It is likely that passengers who use faster modes of transport have a higher values of time. There is very little difference in the elasticity measures for second class passengers by the different routes.

Q19 & Q20. Age Group & Gender

The range of ages shows that a broad cross section of the national population has been sampled, split roughly evenly between men and women. The sample therefore is reliable and free from bias.

Q21 & Q22. Occupation and Monthly Income

The responses to these questions have been aggregated in the form of a cross tabulation. The largest three individual groups were those who are employed, those who are retired, and student/scholars. Together they comprised 81% of passengers.

Due to its sensitivity the question about income was left as optional. Even though only employed and self employed people were asked to provide their monthly income a range of the other employment categories also did the same. Overall about 40% of the respondents replied to this question. Of those who are employed the proportion who responded was 63%. The average monthly income from those who responded was 127151 Leva, which is slightly less than the average national wage of 150,000 Leva (July 1997). The majority of employed/self employed were in the range of 76,000 - 200,000 Leva. The majority of retired had a lower level of income up to 100,000 Leva per month.

Whilst most students/scholars did not respond to this question as they are not yet income earners, some that did indicated a significant income level. This may, however, refer to family income rather than personal. It can be concluded, therefore, that as most of BDZ's passengers are lower income earners they are likely to suffer financial hardship from significant future tariff increases.

BDZ ON TRAIN SURVEY ANALYSIS RESULTS

Q1 & Q3 Origin And Destination Stations

| Origin Stations | | | Destination Stations | | |
|-----------------|-----|---------|----------------------|-----|---------|
| Sofia | 293 | 44.33% | Sofia | 245 | 37.07% |
| Burgas | 60 | 9.08% | Plovdiv | 36 | 5.45% |
| Plovdiv | 55 | 8.32% | Pleven | 35 | 5.30% |
| Kazaniak | 33 | 4.99% | Pazardzhik | 35 | 5.30% |
| Stara Zagora | 24 | 3.63% | Kaspichan | 24 | 3.63% |
| Gomo Onah | 22 | 3.33% | Karlovo | 20 | 3.03% |
| Jambol | 15 | 2.27% | Cherven Bryag | 20 | 3.03% |
| Other Stations | 142 | 21.48% | Kostenets | 18 | 2.72% |
| Uncoded | 17 | 2.57% | Gomo Onah | 15 | 2.27% |
| TOTAL | 661 | 100.00% | Ihtiman | 15 | 2.27% |
| | | | Kazaniak | 14 | 2.12% |
| | | | Other Stations | 160 | 24.21% |
| | | | Uncoded | 24 | 3.63% |
| | | | TOTAL | 661 | 100.00% |
| No. Stations | 39 | | No. Stations | 61 | |

Q2 & Q4 Access And Egress Mode To/From Station

| Access Mode | | | Egress Mode | | |
|------------------|-----|---------|-------------|---------|--|
| 1. Walked | 136 | 20.57% | 180 | 27.23% | |
| 2. Bus/Coach | 334 | 50.53% | 339 | 51.29% | |
| 3. Taxi | 37 | 5.60% | 26 | 3.93% | |
| 4. Motor/Bicycle | 2 | 0.30% | 3 | 0.45% | |
| 5. Car Passenger | 31 | 4.69% | 40 | 6.05% | |
| 6. Car Driver | 31 | 4.69% | 24 | 3.63% | |
| 7. Other | 12 | 1.82% | 16 | 2.42% | |
| 8. Another Train | 12 | 1.82% | 5 | 0.76% | |
| 9. Tram | 48 | 7.26% | 18 | 2.72% | |
| Uncoded | 18 | 2.72% | 10 | 1.51% | |
| TOTAL | 661 | 100.00% | 661 | 100.00% | |

Q5 Journey Purpose

| | | |
|-------------------------------|-----|--------|
| 1. To/From Work | 67 | 10.12% |
| 2. On Employers Business | 141 | 21.30% |
| 3. Visiting Friends/Relatives | 196 | 29.61% |
| 4. Shopping | 34 | 5.14% |
| 5. On Holiday | 62 | 9.37% |
| 6. To/From School/College | 89 | 13.44% |
| 7. Other | 60 | 9.08% |
| Uncoded | 12 | 1.81% |
| TOTAL | 661 | 99.85% |

Q6 Journey Frequency

| | | |
|-------------------------|-----|---------|
| 1. Several Times a Week | 81 | 12.25% |
| 2. Once a Week | 53 | 8.02% |
| 3. 2-3 Times a Month | 95 | 14.37% |
| 4. Once A Month | 163 | 24.66% |
| 5. 5-6 Times a Year | 26 | 3.93% |
| 6. 3-4 Times a Year | 67 | 10.14% |
| 7. 1-2 Times a Year | 155 | 23.45% |
| Uncoded | 21 | 3.18% |
| TOTAL | 661 | 100.00% |

Q7 Outward/Return Trip

| | | |
|------------|-----|---------|
| 1. Outward | 425 | 64.30% |
| 2. Return | 224 | 33.89% |
| Uncoded | 12 | 1.82% |
| TOTAL | 661 | 100.00% |

Q8 Train Type

| | | |
|------------|-----|---------|
| 1. Express | 36 | 5.45% |
| 2. Fast | 613 | 92.74% |
| 3. Normal | 4 | 0.61% |
| Uncoded | 8 | 1.21% |
| TOTAL | 661 | 100.00% |

Q9 Carriage Class

| | | |
|-----------|-----|---------|
| 1. First | 117 | 17.70% |
| 2. Second | 536 | 81.09% |
| Uncoded | 8 | 1.21% |
| TOTAL | 661 | 100.00% |

Q10 Choice Of Rail

| | | |
|-----------------------------|-----|---------|
| 1. Shorter Journey Time | 22 | 3.33% |
| 2. Safer by Rail | 19 | 2.87% |
| 3. No Alternative Transport | 193 | 29.20% |
| 4. Cheapest Mode | 264 | 39.94% |
| 5. More Comfortable | 81 | 12.25% |
| 6. More Frequent/Convenient | 56 | 8.77% |
| 7. Other | 8 | 1.21% |
| Uncoded | 16 | 2.42% |
| TOTAL | 661 | 100.00% |

Q11 Ticket Type

| | | |
|-----------------------------|-----|---------|
| 1. Single Fare | 192 | 29.05% |
| 2. Return Fare | 84 | 12.71% |
| 3. Student Single Fare | 124 | 18.76% |
| 4. Pensioner Single Fare | 95 | 14.37% |
| 5. Armed Forces Single Fare | 25 | 3.78% |
| 6. One Month Season | 9 | 1.36% |
| 7. Three Month Season | 10 | 1.51% |
| 8. Free Ticket | 46 | 6.96% |
| 9. BDZ Staff Pass | 57 | 8.62% |
| 10. Other | 7 | 1.06% |
| Uncoded | 12 | 1.82% |
| TOTAL | 661 | 100.00% |

Q12 Ticket Payment

| | | |
|---------------------------|------------|----------------|
| 1. By Employer | 160 | 24.21% |
| 2. By Education Authority | 3 | 0.45% |
| 3. By Family Member | 103 | 15.58% |
| 4. By Own Money | 347 | 52.50% |
| 5. Other | 7 | 1.06% |
| Uncoded | 41 | 6.20% |
| TOTAL | 661 | 100.00% |

Q13 Ticket Price

| | | |
|--------------------------|------------|----------------|
| 1. Less Than 500 Leva | 6 | 0.91% |
| 2. 501 - 1000 Leva | 100 | 15.13% |
| 3. 1001 - 2000 Leva | 189 | 28.59% |
| 4. 2001 - 3000 Leva | 115 | 17.40% |
| 5. 3001 - 4000 Leva | 43 | 6.51% |
| 6. 4001 - 5000 Leva | 14 | 2.12% |
| 7. 5001 - 6000 Leva | 18 | 2.72% |
| 8. 6001 - 7000 Leva | 4 | 0.61% |
| 9. 7001 - 8000 Leva | 4 | 0.61% |
| 10. 8001 - 9000 Leva | 3 | 0.45% |
| 11. 9001 - 10000 Leva | 0 | 0.00% |
| 12. More than 10000 Leva | 3 | 0.45% |
| Uncoded | 162 | 24.51% |
| TOTAL | 661 | 100.00% |

Q14 Fare Elasticities

| | Elasticity | Sample Size |
|-------------------------------|------------|-------------|
| First Class - Combined | -1.54 | 32 |
| Second Class - Combined | -0.81 | 330 |
| Second Class - Northern Route | -0.56 | 109 |
| Second Class - Central Route | -0.89 | 111 |
| Second Class - Southern Route | -1.00 | 99 |

Q15 Alternative Arrangements (If Fares Increase Too Much)

| | | |
|----------------------|------------|----------------|
| 1. Travel By Bus | 201 | 30.41% |
| 2. Travel By Car | 68 | 10.29% |
| 3. Travel By Air | 9 | 1.36% |
| 4. Travel Elsewhere | 35 | 5.30% |
| 5. Not Travel at All | 190 | 28.74% |
| 6. Other | 28 | 4.24% |
| Uncoded | 130 | 19.67% |
| TOTAL | 661 | 100.00% |

Q16 Journey Time

| | | |
|---------------------------|------------|----------------|
| 1. Up to 30 Minutes | 11 | 1.66% |
| 2. 31 - 60 Minutes | 38 | 5.75% |
| 3. 61 - 90 Minutes | 54 | 8.17% |
| 4. 91 - 120 Minutes | 51 | 7.72% |
| 5. 121 - 180 Minutes | 114 | 17.25% |
| 6. 181 - 240 Minutes | 66 | 9.98% |
| 7. 241 - 300 Minutes | 80 | 12.10% |
| 8. 301 - 360 Minutes | 43 | 6.51% |
| 9. 361 - 420 Minutes | 71 | 10.74% |
| 10. 421 - 480 Minutes | 27 | 4.08% |
| 11. 481 - 540 Minutes | 7 | 1.06% |
| 12. 541 - 600 Minutes | 1 | 0.15% |
| 12. More than 600 Minutes | 8 | 1.21% |
| Uncoded | 90 | 13.62% |
| TOTAL | 661 | 100.00% |

Average Journey Time (Mins) = 234

Q17 & Q18 Journey Time Elasticities

| | Elasticity | Sample Size |
|-------------------------------|------------|-------------|
| First Class - Combined | -0.97 | 63 |
| Second Class - Combined | -0.67 | 282 |
| Second Class - Northern Route | -0.63 | 102 |
| Second Class - Central Route | -0.71 | 92 |
| Second Class - Southern Route | -0.69 | 88 |

Q19 Age Group

| | | |
|-----------------------|------------|----------------|
| 1. Less than 15 years | 3 | 0.45% |
| 2. 15 - 19 Years | 32 | 4.84% |
| 3. 20 - 24 Years | 138 | 20.88% |
| 4. 25 - 29 Years | 73 | 11.04% |
| 5. 30 - 39 Years | 88 | 13.31% |
| 6. 40 - 49 Years | 107 | 16.19% |
| 7. 50 - 59 Years | 99 | 14.98% |
| 8. 60 - 69 Years | 79 | 11.95% |
| 9. 70 Years or more | 27 | 4.08% |
| Uncoded | 15 | 2.27% |
| TOTAL | 661 | 100.00% |

Q20 Gender

| | | |
|--------------|------------|----------------|
| 1. Male | 306 | 46.29% |
| 2. Female | 337 | 50.98% |
| Uncoded | 18 | 2.72% |
| TOTAL | 661 | 100.00% |

Q21 & Q22. Occupation and Monthly Income

| Employment Categories | Average Monthly Income (000 Leva) | | | | | | | | | | TOTAL | % |
|---------------------------|-----------------------------------|---------------|---------------|---------------|---------------|--------------|--------------|--------------|------------|------------|----------------|---|
| | Up to 50 | 51-75 | 76-100 | 101-150 | 151-200 | 201-250 | 251-300 | >300 | N/A | | | |
| 1. Employed | 3 | 17 | 49 | 48 | 39 | 7 | 7 | 3 | 101 | 274 | 41.58% | |
| 2. Housewife | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 13 | 1.97% | |
| 3. Farmer | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0.15% | |
| 4. Self Employed | 1 | 2 | 2 | 6 | 4 | 0 | 0 | 2 | 16 | 33 | 5.01% | |
| 5. Retired | 17 | 12 | 8 | 1 | 1 | 0 | 0 | 0 | 95 | 134 | 20.33% | |
| 6. Unemployed/Not Working | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 24 | 28 | 4.25% | |
| 7. Student/Scholar | 3 | 2 | 6 | 4 | 2 | 0 | 0 | 1 | 108 | 126 | 19.12% | |
| 8. Armed Forces | 6 | 0 | 0 | 2 | 3 | 1 | 2 | 0 | 16 | 30 | 4.55% | |
| 9. Other | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 5 | 0.76% | |
| 10. Uncoded | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 15 | 2.28% | |
| TOTAL | 36 | 35 | 66 | 61 | 49 | 8 | 9 | 6 | 389 | 659 | 100.00% | |
| % (1) | 13.33% | 12.96% | 24.44% | 22.59% | 18.15% | 2.96% | 3.33% | 2.22% | | | | |

Average Monthly Income From All Respondents (Leva) = 127151

Note (1) Percentage Calculated From Respondents Only

1.3 BDZ FREIGHT TRAFFIC ANALYSIS BY QUARTER YEARS

| | Tonne Kms (Million) | | | | Revenue (Million Leva) | | | | Average Rev. (Leva Per Tonne Km) | | | |
|------------|---------------------|---------------------|---------------|-------|------------------------|---------------------|---------------|-------|----------------------------------|---------------------|---------------|-------|
| | Purely Domestic | Domestic Only Ports | International | Total | Purely Domestic | Domestic Only Ports | International | Total | Purely Domestic | Domestic Only Ports | International | Total |
| 1Q 1996 | 897 | 659 | 231 | 1797 | 1464 | 948 | 673 | 3085 | 1.63 | 1.42 | 2.91 | 1.72 |
| 2Q 1996 | 884 | 808 | 194 | 1887 | 1321 | 1688 | 736 | 3745 | 1.49 | 2.09 | 3.79 | 1.98 |
| 3Q 1996 | 993 | 830 | 179 | 2002 | 1930 | 3162 | 1087 | 6179 | 1.94 | 3.81 | 6.07 | 3.09 |
| 4Q 1996 | 914 | 794 | 155 | 1863 | 2247 | 4552 | 1530 | 8329 | 2.46 | 5.73 | 9.87 | 4.47 |
| Total 1996 | 3688 | 3102 | 759 | 7549 | 6962 | 10350 | 4026 | 21338 | 1.89 | 3.34 | 5.30 | 2.83 |
| 1Q 1997 | 745 | 917 | 151 | 1813 | 5478 | 20083 | 5981 | 31542 | 7.35 | 21.90 | 39.61 | 17.40 |
| 2Q 1997 | 695 | 976 | 170 | 1841 | 22115 | 24329 | 6432 | 52876 | 31.82 | 24.93 | 37.84 | 28.72 |
| 3Q 1997 | 903 | 800 | 167 | 1870 | 27434 | 21471 | 7176 | 56081 | 30.38 | 26.84 | 43.06 | 30.00 |

1.4 BDZ RECOMMENDED 'REAL' TARIFF INCREASES

Passenger

1. 1998 - 2002 : 3-5% a year with increased market related tariffs;
2. 2003 - 2005 : 10 - 15% a year with a change in the tariff structure set by individual origin/destination station pairs;
3. 2005 + : 2% per year as the new tariff structure is adjusted and fine tuned.

Freight

1. International Traffic : Fixed by international tariff agreements. Traffic growth rather than tariff increases is the principal means of revenue growth. A 5% growth in real tariffs has been assumed to occur every five years;
2. Ports Traffic : Revenue growth per tonne kilometre has lagged behind that of domestic traffic. An overall increase of 20-30% early in 1998 appears feasible either by changing the January 1993 tariff structure or by altering the selective discounts to individual customers. Small real increases, e.g. 2% a year in total should be possible thereafter until the opening of the Plovdiv - Burgas/Varna motorway in 2015 which will lead to a severe increase in road competition for all commodities. A sharp overall decrease in tariffs, e.g. 20 - 25% is envisaged after this;
3. Domestic Traffic : The substantial tariff increases early in 1997 appear to have had no appreciable affect on traffic volumes. No tariff increases have occurred since April 1997. An additional real increase of 10 - 20% early in 1998 appears feasible. Thereafter small real increases should be feasible (annually 2% to the year 2005 and 1% thereafter as road traffic growth increases). Of the domestic traffic, petroleum products (from Burgas) will be the main commodity suffering competition and depressed tariffs from the opening of the new motorway.

Costing and Cost Allocation

1. The reinstatement of OSCAR and the ability to set tariffs at marginal rates should generate new traffic, particularly from the domestic and ports markets. A 5% overall increase in these markets should be achievable by the year 2001;
2. The implementation of the MIS system including the FMS and FOS will improve the quality of cost information and quality of service to freight customers. The former will allow a more accurate identification of costs by activities and as a result operating cost savings and increased productivity of at least 10% should be achievable. The improved service in itself will generate additional traffic, particularly with high value cargoes where service quality is important. A 5-10% in total freight traffic should be achievable, with revenue growth of at least 10%.

2. APPENDIX FOR ENVIRONMENTAL ANALYSIS OF CHAPTER 7.7

7.7.1 Overview of Current Environmental Policy for Railways

(1) EU Environmental Policy in Transport

The various forms of transport have been central to economic growth in the world and to the quality of life of its citizens, transport is well known as a major source of pollution in the world today and various modes of transport are the main source of nitrogen (NO_x) and carbon monoxide (CO) which are major pollutants of the urban environment. While other sectors have been able to reduce their environmental impacts, the environmental damage caused by the transport sector continues to increase.

In conjunction with its Member States, the Community has tried to develop a global strategy aimed at maintaining mobility while preserving the environment. Obviously, it is up to regional and local governments to introduce measures that are effective and command popular support.

Foremost among these will be the introduction of vehicle producing little or zero emission and the development of rapid, convenient public transport.

In order to achieve a balance in the development of the various transport modes, and cater to the imperative of environmental protection, it is vital that the environmental external cost of transport be taken into account and passed on to the user as part of the price. Adjusting the cost in this way provides for environmental protection on a fair market basis, as laid down in Article 130r (2) of the Treaty of European Union:

“The Community policy shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay. Environmental protection requirements must be integrated into the definition and implementation of other Community policies”.

Regarding railway transport in the Community, the long term challenge for European transport policy is to ensure continued development of mobility while at the same time protecting the environment which will mean reducing air pollution, noise levels and the consequences of accidents.

(2) National Environmental Policy and Transport

Basic legislation on environmental protection in Bulgaria was established in the 1960s and amended in the 1970s and 1980s. However this environmental legislation was formulated in the period of central government planning and was so strict as to be unenforceable. Because of this the legislation did not meet the required objectives at that time. After a market-based economy was introduced, realistic requirements for environmental legislation have been formulated.

The environmental challenge for Bulgaria in the economic transition period is to ensure maximum environmental benefits not only from economic growth but also from economic reform and structural changes, by integrating environmental concerns into economic decisions. The following instruments were introduced to enhance implementation of the environmental

policy.

1) Regulatory Instruments

a. Standards

The environmental standards created by the former central planning based economic system were so strict that they were unenforceable, they were, in many cases, more stringent than WHO guidelines. More realistic requirements for environmental protection were therefore introduced.

b. Enforcement

Charging fines when environmental standards are exceeded is major instrument of environmental protection. The fines levied go to an Environmental Protection Fund for investment in environmental protection projects.

2) Assessing Environmental Impact

The Environmental Protection Law introduced procedures for Environmental Impact Assessment. The EIAs are mandatory for the development or refurbishment of major projects and bodies such as Environmental Experts Council and Regional Environmental Inspectorates are charged with ordering and approving the EIAs.

3) Economic Instruments

The laws impose user charges on usage of natural resources as well as waste discharge in order to enhance environmental protection, economic instruments for user charge policy are introduced

- Solid waste charges (households and enterprises)
- Water use charges (water supply and waste water treatment)
- Waste water discharge charges (discharge to sewerage system)
- Administrative charges (environmental administrative actions)
- Charges on quarrying (quarried materials)
- Timber taxes and charges (domestic timber sales and export)
- Pollution fines (excess of permissible level)
- Car import duties (additional tax on cars older than 10 years)
- Tariff reduction on imports (environmental equipment)
- Excise tax differentiation (tax on leaded gasoline 10% higher)

4) Environment and Transport

There are only a few items related to the transport sector in the Environmental Protection Law and the most of these concern vehicle emissions from lead containing gasoline. The 1994 Environmental Strategy Update emphasizes to increase use of lead free gasoline. This will require incentives for use of lead free gasoline.

In addition, more stringent emission levels for vehicles, especially diesel engines for buses, are suggested. The Ministry of Environment has conducted a pilot project to rebuild bus engines in collaboration with the Sofia City Municipality.

Moreover, growth in the number of vehicles and in traffic in major cities, particularly Sofia

will mandate the limitation of emission levels by motorcars. In cooperation with the Ministry of Environment, Ministry of Transport and Sofia Municipality, strong measures for limiting motor vehicle emission levels in the city centers will be taken. Other steps, such as improvement of parking control, promotion of public transport to reduce commuter traffic by car, will be considered.

(3) Environmental Aspects of the Existing Railway System

Four major environmental issues related to railways were identified in the study: Railway Reconstruction Project (RRP) by EBRD, 1) waste water discharge and treatment; 2) waste disposal; 3) chemical application; 4) veterinarian control and coach hygiene.

Railway rehabilitation would improve its competitiveness over its main competitor, automobile transport, and would bring overall environmental benefits.

a. Waste water discharge and treatment

Waste water discharge is the most significant cause of systematic violation of Bulgaria's environmental standards by railways. BDZ has nine major depots and each of them had to pay fines in accordance with water sampling data which showed allowed levels had been exceeded. BDZ paid 1,238,485 Leva (equivalent to US\$44,000) in 1993 as fines. The Sofia depot accounted for 77% of these fines and Durujba Depot paid 15%. It is reported that proactive countermeasures, housekeeping and low cost solutions, were carried out in depot and workshop. As a result of these activities to protect the environment utilizing sediment depositories and treatment facilities for waste water, the pollution issues was significantly improved.

b. Solid waste in depot and workshop

Solid waste is generated in both in operation and maintenance at depot and workshop. Characteristics of solid waste are caused by passenger waste in depot and maintenance stations and freight waste leftover in wagon from freight cargoes. This left over waste such as chemical freights is easily lead to soil and ground water contamination and create health risks for the staffs. In addition nickel batteries stored on the ground also occurs the contamination.

c. Chemical application for track maintenance

Chemicals have been used for track maintenance with a new to track safety. However, chemicals should be used carefully because they may spread to surrounding areas such as agricultural lands.

d. Veterinarian control and coach hygiene

This is quite an important aspect of the environment. There are thirteen (13) specialized quarantine stations able to operate in accordance with the hygiene regulation incorporated in the Veterinarian Activity Act. However, two items would need to be improved; regulations for proper treatment of freight cars after use and instructions for dealing with the consequences of accidents involving hazardous cargoes. Only one fine was reported for the improper handling of railway cars in connection with transportation of hazardous car.

(4) Environmental Affects of Existing Plans Formulated for the Railways

Two railway plans have been formulated 1) Bulgaria: Railway Rehabilitation Project by EBRD (RRP), 2) Management Plan of BDZ for the Period up to 2005 by BDZ (BDZ2005 Plan) and one on-going plan, Railways' Environmental Performance Improvement Project (REPIP). These three plans aim to upgrade the service level in the short term. A comparison of the two plans formulated is given in following table:

Table 7.7.1 Environmental Issues and Countermeasures in Existing Railways Rehabilitation Plan

| Policy Plans | Issues | Countermeasure |
|-------------------------------------|---|---|
| EBRD Railway Rehabilitation Project | <ol style="list-style-type: none"> 1) Waste water discharge and treatment 2) Solid waste 3) Chemical application 4) Veterinarian control and car hygiene | <p>Recommendation:</p> <ol style="list-style-type: none"> 1) Environmental management capacity 2) Setting environmental priorities 3) Incorporating environmental concern in the BDZ restructuring <p>EBRD Loan:</p> <ol style="list-style-type: none"> 1) Rehabilitation of locomotive workshop (water treatment plant and sediment treatment plant for waste drainage water from the washing of the locomotives and wagons) 2) Ballast management wagons for ballast pollution outputs |
| BDZ 2005 Plan | <ol style="list-style-type: none"> 1) Breach of environmental standards 2) Uncontrolled disposal of waste 3) discharge water from passenger cars 4) Improper application of chemicals 5) Improper veterinarian control 6) insufficient hygiene norms and procedures | <ol style="list-style-type: none"> 1) Improvement of environmental condition in depot and workshop and its vicinity 2) Adoption of certain standards for registered environmentally hazardous material used or transported by train 3) development of environmental technology coordinated with European railways |

Source: JICA Study

The Railways' Environmental Performance Improvement Project (REPIP) has commenced and is financed by the European Union. The objectives of the project are :

- to develop a comprehensive phased strategy for strengthening the organizational and management arrangements, and updating the existing facilities of BDZ for veterinary and hygiene control at border crossings, and
- prepare detailed organizational management proposals, engineering designs and technical specifications, and program for implementation of the first phase of the approved plan.

7.7.2 Social Environmental Impact Examination

The most considerable aspects of social impact of the plan, reducing staff, raising tariffs, ceasing service in lines, are discussed in this clause with qualitative analysis. The results of the social environmental condition survey on railway service carried out in feeder lines were taken into account in this examination.

(1) Overview

1) Reducing Staff

The plan proposed reducing staff number gradually utilizing the difference between staff recruitment and staff wastage which is an acceptable method and not controversial for the people concerned. It is therefore considered that the social impact from this activity is not significant.

2) Tariff Increases

A passenger tariff increase of 3-5% annually is proposed for the years 1998-2002, of 10-15% annually year 2003-2005 and after year 2005, 2% annually, however, fares have already increased by over 700% during February to April 1997. The tariff is fixed based on market pricing principles and further increases in line with the growth rate of GDP would be acceptable, so that the social impact of tariff increases is considered not significant.

3) Ceasing Service on Lines

It would seem that discontinuing service on feeder lines would be logical given that frequency of current railway operations in feeder lines has greatly decreased and passenger and freight demand are also much less. The management plan intends to have no improvement on this matter. In addition, alternative transport such as buses and trucks are available at similar cost. Consequently the social impact is deemed not to be significant when the plan is implemented.

(2) Reducing Staff

1) Present Situation of Projected of Staff Reducing

Further staff reductions were projected in the PFR (Program for Financial Rehabilitation) and the Management Plan for BDZ up to the Year 2005. This has been overtaken by the policy of a new Management Team which had already reduced the staffing levels and has set new targets up to the end of 1998. The current staffing position and specific forecasts are as follows:

Table 7.7.2 Current Staffing Position

| | |
|--|---------------------------|
| Actual Number of staff at June 1997 | 56,573 |
| Planned number of staff July 1997 | 52,121 (Manpower Plan) |
| Actual number of staff July 1997 | 54,599 |
| Estimated staff at the end of 1997 | 51,200 * |
| Planned number of staff at end of 1998 | 44,200 (Operations only)* |
| Planned number of staff at end of 1998 | 47,300 (Whole of BDZ) * |

* These are the figures that were included in the Rehabilitation Plan in April 1997 and are also included in the 1997 -1998 contract between the State and BDZ.

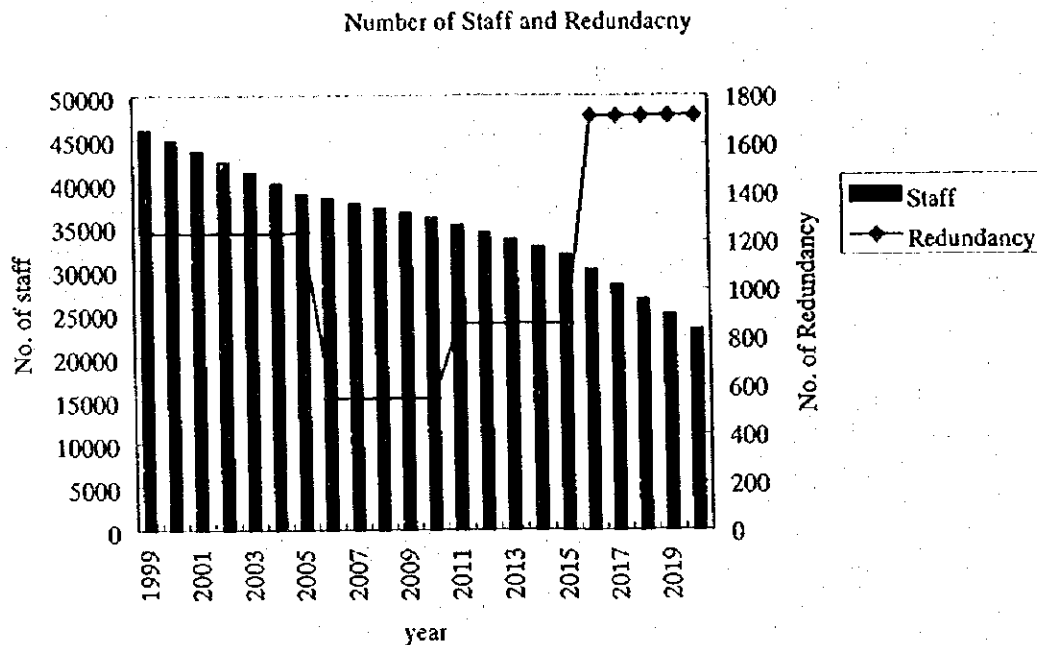
Source: JICA Study

The target staffing figures for 1997 and 1998 assume the implementation of a considerable number of staff reduction schemes included in the original 3 Year Plan. This plan is largely focused on the establishment of Joint Venture Companies or Joint Stock Companies for construction, maintenance and consultancy activities.

2) Reducing Staff and Social Impact

A Strategy for reducing the numbers of staff in the plan is based on the manipulation staff recruitment and staff wastage so that the social impact on this activity is minimal.

It is considered that the two key ingredients in producing an acceptable, non-controversial approach to reducing staff numbers will be Staff Recruitment and Staff Wastage. Providing recruitment can be regulated to provide a significantly lower annual figure than natural staff wastage, then it should be possible to make acceptable staffing and establishment reductions without causing undue problems. It is therefore considered that the social impact caused by staff reductions under the plan will be minimal.



Source: JICA Study

Figure 7.7.1 Proposed Number of Staff and Redundancy 1999-2020

(3) Tariff Increases

1) Summary of Policy on Tariff Increases

In the Management Plan, tariff increases both for passenger and freight tariff are proposed summarized below. The most important effect of tariff increases on social impacts is from passenger tariffs. For the first five years from 1998 to 2002, the rate of increasing is 3 to 5% a year with a market related tariff and for the next three years from 2003 to 2005, the rate of increasing is 10 to 15% a year with the tariff structure set by individual origin/destination station pairs. Beyond year 2005, rate of increasing is 2% a year as the new tariff structure is adjusted and fine tuned. Before the above plan proposal, the tariff was dramatically increased by 700% early 1997.

Table 7.7.3 Summary of Proposed Tariff Increases

| Category | Subject Year | Tariff Increases |
|------------------|-----------------|--|
| 1. Passenger | 1998-2002 | 3-5% a year with a market related tariff |
| | 2003-2005 | 10-15% a year with a change in the tariff structure set by individual origin/destination station pairs |
| | over 2005 | 2% per year as the new tariff structure is adjusted and fine tuned |
| 2. Freight | | |
| 1) International | | Fixed by international tariff agreements |
| 2) Ports Tariff | early 1998 | 20-30% |
| | after that-2015 | small increase e.g. 2% a year |
| | Beyond 2015 | a sharp overall decrease in tariff e.g. 20-25% |
| 3) Domestic | early 1998 | 10-20% increase |
| | 1998- | a small increase |

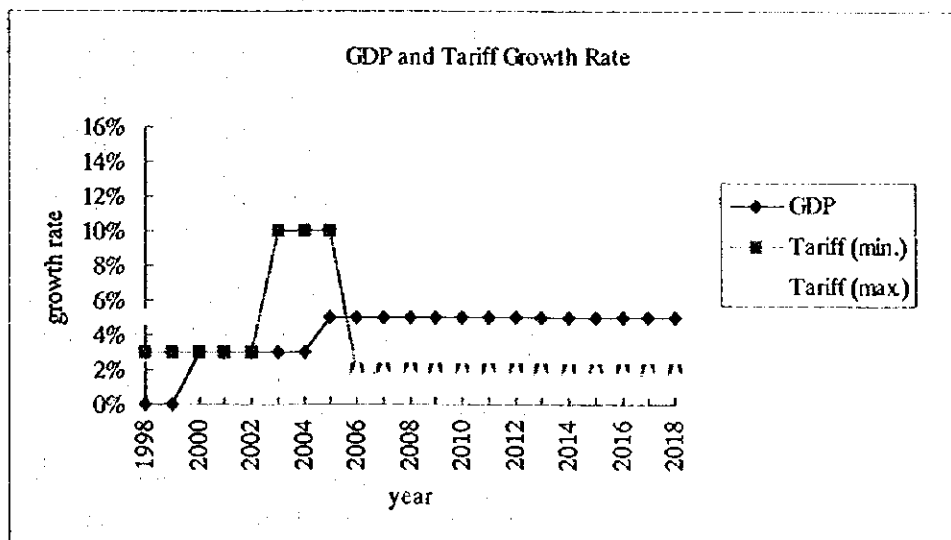
Source: JICA Study

2) Tariff Increase and Social Impact

In response to the economic growth (GDP) forecast, there are three phase; 0% growth per year up to year 2000, 3% growth per year 2000-2005 and 5% growth per year beyond year 2005.

It should be mentioned that tariffs have already been increased by 700% from February to April 1997 based on market pricing principles.

In terms of duration of the plan, average growth rate of GDP is at 4.13% while average tariff increase rates are at 3.26% to 4.35%. It is considered that this is an acceptable increase rate if when compared to GDP growth.



Source: JICA Study

Figure 7.7.2 GDP Growth and Tariff Increase Rate Projection

In addition, the results of interview survey on railway services show that around 75% of the people would not accept an increase of more than 30%. In other words, it might be said that an increase of less than 30% would be acceptable. Approximately 30% of the respondents agreed on the principle of self financed fares and one third of respondents agreed on fare increases, if the railway service would not be financially sustainable at present .

It is therefore proposed that the maximum tariff increase rate is at 15% for three years from year 2003-2005 that the GDP starts to grow at 3%. The tariff increase rate in other periods is from 3% to 5% which is nearly equal to the GDP growth rate. It is believed that the tariff increase rate will be acceptable to the people so that the social impact of tariff increases will not be significant.

Table 7.7.4 Results of Interview Survey on Tariff for Feeder Lines

| | | |
|---|---|--|
| 4.1 Do you agree that railway services should be self financed from fares? | a. Agree (27.9%) b. Not Agree (72.1%) | No specified reasons (27.3%) There are specified reasons (72.7%): |
| 4.2 If the railway services are not financially sustainable, do you agree that the train fares should increase? | a. YES (33.4%) b. NO (66.6%) | No specified reasons (24.6%) There are specified reasons (75.4%) |
| 4.3 What level of fares increase would cause you to stop using the train services? | a. 10% (24.2%) b. 30% (24.4%) c. 50% (23.1%) d. 75% (4.4%) e. 100% (8.7%) | f. 200% (1.1%) g. over 200 % (1.1%) h. I will travel by train, does not mater the fare (13.1%) |

Source: Household Interview Survey (JICA)

(4) Ceasing Service on Certain Lines

Referring to the train operation schedule of feeder lines, some examples are shown in the following table, showing low frequency of train operation including passenger, freight and combined trains. Some lines are operated daily, however one of the lines is operated only on Saturday and Sunday.

Table 7.7.5 Schedule of Feeder Lines

| No. | Subject Lines | Current Operation Schedule (Sep.1997) |
|-----|---|---------------------------------------|
| 1. | No.16 Septiemvri - Dobrinishte (119 km) | two times (P) and one time (f) a day |
| 2. | No.21 Cherven Briag - Oriahovo (104 km) | two times (P) and one time (f) a day |
| 3. | No.25 Levski - Troyan (83 km) | two times (P) and one time (f) a day |
| 4. | No.41 Gorna Oriahovitsa - Elena (44 km) | Once a day on Sat. and Sun. |
| 5. | No.91 Samuil - Silistra (113 km) | 2 times a day (combined) |

Source: JICA Study

In this manner, frequency of train operation is much less and future demand estimated is also less due to the decline of major industry along the lines while alternative transports such as buses and tracks are introduced with more frequency service.

The results of the interview survey shown in the table below. Nearly half of respondents say that alternative transport such as buses is required either if tariff increases or lines cease. In other word, if there is alternative transport such as bus service, it is less impact on ceasing lines.

This is the fact that 10% of respondent agree while 90% of respondents disagree on ceasing lines, however, viewpoints from car ownership (44%) and frequent use of railway (36%), those number shows positive aspect of alternative transport existents.

So small number of people affected will use alternatives more frequent mean of transport, so the social impact of ceasing service on these lines will not be significant.

Table 7.7.6 Interview Survey Result on Ceasing Service in Feeder Lines

| | | |
|--|---|---|
| 2.1 Do you have own car or Does your family have own car? If "YES", how many cars do you have? | a. YES (44.2%) b. NO (55.8%) If YES, please specify how many: | One 93.6% Two 5.2 % Three 1.0% Five 0.2% |
| 2.2 Which transport mode do you most frequently use? (Select one item) | a. Railway Train (36.3%) b. Tram (0.4%) c. Bus (36.5%) d. Trolley Bus (0.4%) | e. Private Car (17.7%) f. Bicycle (3.0%) g. Other (Specify) (5.7%) |
| 4.4 What would you then do instead? (If railway tariff increased) | a. Use alternative bus service (53.8%) b. Take a taxi (-) c. Hitch-hike (2.6%) | d. Travel elsewhere (-) e. Not travel at all (24.8%) f. Other (18.9%) |
| 4.5. If there is alternative transport available, do you use the railway? | a. Yes (51.7%) b. No (48.3%) | No specified reasons (27.9%) There are specified reasons (72.1%) |
| 4.6. If the railway services in your local area ceased operations would you agree? | a. Yes (9.7%) b. No (90.3%) | No specified reasons (21.5%) There are specified reasons (78.5%) |
| 4.7 If the railway services in your local area ceased operations, what would you require? | a. I would need alternative transport (41.4%) | b. I don't require any thing (46.2%) c. Other (Specify) (12.4%) |

Source: Household Interview Survey (JICA)

7.7.3 Natural Environmental Impact Examination

(1) Initial Environmental Examination (IEE)

An Initial Environmental Examination (IEE) of the plan was carried out using existing data, information and supplementary natural environmental condition surveys on related sites. The plan has been formulated in Chapter 8 and summarized in the following tables.

The Initial Environmental Examination (IEE) is to identify negative impacts in a preliminary way through the Screening and Scoping activities as explained below. Then environmental considerations are assessed, if required. These environmental issues will be considered for further detailed examination in a Environmental Impact Assessment.

▪ Screening

The purpose of screening of environmental aspects is to identify environmental impacts and social issues which would be examined in more detail if a full scale assessment (Environmental Impact Assessment: EIA) is necessary in future.

▪ Scoping

The purpose of scoping is to clarify the significant environmental impacts which may be caused by the project.

1) Overview

In consideration of the nature of the plan which includes various kinds of institutional programs, and of the improvements of railway, an integrated IEE on this plan was carried out. As a result of Screening and Scoping, two major impacts, 1) waste and 2) noise and vibration during operation stage were identified. However no other major negative impacts were identified.

It was therefore concluded that an Environmental Impact Assessment (EIA) is not required.

Table 7.7.7 Summary of Long Term Management Plan of Bulgarian Railway

| Proposed Plan | Components |
|--|--|
| 1. Reorganization of Freight Department of BDZ | |
| 2. Marketing and Sales | 1) Freight 2) Passenger |
| 3. Tariff Improvement | 1) Freight tariff 2) Passenger tariff |
| 4. Train Operation Plan | 1) Competitive train 2) Future high speed train 3) Computerized adaptation of train diagram to forecast demand 4) Train Speed Improvement 5) Plans improving train operation of main issues 6) Planned train for financial projection |
| 5. Facilities and Rolling Stocks | 1) Reinstatement of deferred maintenance 2) Investment to combined transport 3) Maintenance and improvement |
| 6. Human Resources | 1) Planed manpower /pay level for financial projection 2) Pay system, incentive and management change 3) Personnel and training organization |
| 7. Less traffic density lines | 1) Continued rationalization and cost reduction 2) Transfer to related company 3) PSO subsidizing |

Source : JICA Study

2) Screenig

As a result of screening, no major impact were identified except noise and vibration and waste. It is concluded that Environmental Impact Assessment is not required at all as follows:

Table 7.7.8 Screening of Long Term Management Plan of Bulgarian Railway

| No. | Environmental Items | Description | Evaluation | Remarks (reason) |
|----------------------------|-----------------------------------|--|--|---|
| Social Environment | | | | |
| 1. | Resettlement | Resettlement by occupancy of proposed land | No | Existing ROW is used |
| 2. | Economic Activities | Loss of productive opportunity such as land | No | Less change of economic activities |
| 3. | Traffic and Public Facilities | Influence of existing traffic such as congestion | No | Public facilities exist in the project area |
| 4. | Split of Communities | Split of Communities by obstruction of railway line | No | Non access control cause no obstruction |
| 5. | Cultural Property | Loss of cultural property and falling of values | No | Cultural heritage do not exist |
| 6. | Water Rights and Rights of Common | Obstruction of fishing rights, water rights, and common rights of forest | No | treatment facility exists |
| 7. | Public Health Condition | Deterioration of a hygienic environment by production of refuse and noxious insect | No | Lots of refuse will not produced |
| 8. | Waste | Occurrence of waste dumps and solid waste | Yes | wastes will be produced |
| 9. | Hazards (Risk) | Increase of possibility of danger of landslide and accident | No | Less possibilities to occur |
| Natural Environment | | | | |
| 10. | Topography and Geology | Change of valuable topography and geology by excavation or filling works | No | Large scale of earth work is not included |
| 11. | Soil Erosion | surface soil erosion by rainwater after land development (vegetation removal) | No | Subjected area is developed already |
| 12. | Ground Water | Change of distribution of ground water by large scale excavation | No | No large scale excavation |
| 13. | Hydrological Situation | Change of river discharge and riverbed condition due to landfill and drainage inflow | No | Subject area is developed |
| 14. | Coastal Zone | Coastal erosion and sedimentation due to landfill or change in marine condition | No | No plan along the coast |
| 15. | Flora and Fauna | Obstruction of breeding and extinction of spices due to change of habitat condition | No | developed land |
| 16. | Meteorology | Change of temperature, precipitation, wind ,etc., due to large scale development | No | There are no large scale development |
| 17. | Landscape | Change of topography and vegetation by land development and harmonious obstruction by structural objects | No | no new construction |
| Pollution | | | | |
| 18. | Air Pollution | Pollution caused by exhaust gas or toxic gas from vehicles and factories | No | less exhaust gas |
| 19. | Water Pollution | Pollution by inflow of silt, and effluent into rivers and ground water | No | there is treatment facilities |
| 20. | Soil Contamination | Contamination of soil by dust and chemicals | No | No activities with chemicals |
| 21. | Noise and Vibration | Noise and vibration generated by railway | Yes | During operation |
| 22. | Land Subsidence | Deformation of land and land subsidence due to the lowering of ground water | No | already developed area |
| 23. | Offensive Odor | Generation of exhaust gas and offensive odor by facility construction and operation | No | No factor |
| Overall evaluation | | Environmental Impact Assessment (EIA) is required or not | From the results of the evaluation, EIA is not required. | |

3) Scoping

Noise and vibration due to improvement in operation speed including high-speed trains and waste generation in operational stage shall be examined in more detail when the plan carried out.

Table 7.7.9 Scoping (Long Term Management Plan of Bulgarian Railways)

| No. | Environmental Items | Evaluation | Remarks (reason) |
|----------------------------|-----------------------------------|------------|---|
| Social Environment | | | |
| 1. | Resettlement | D | Resettlement will not occur due to improvement of existing railway |
| 2. | Economic Activities | D | Important changes in economic activities will not occur |
| 3. | Traffic and Public Facilities | D | Developed lands are used. There is no impact on schools, medical, religious facilities in urbanized areas |
| 4. | Split of Communities | D | Access is already controlled and there is no new split the community |
| 5. | Cultural Property | D | There is no impacts in cultural properties in urbanized areas |
| 6. | Water Rights and Rights of Common | D | Treatment facility exists. |
| 7. | Public Health Condition | D | Large amounts of refuse will not occur |
| 8. | Waste | B | Small amount of waste will be produced in the operation stage |
| 9. | Hazards (Risk) | D | There is little possibility of natural disaster |
| Natural Environment | | | |
| 10. | Topography and Geology | D | Large scale land development is not included |
| 11. | Soil Erosion | D | Large scale soil erosion has not been identified |
| 12. | Ground Water | D | There is no large scale structure affecting the under ground condition |
| 13. | Hydrological Situation | D | No structures will be built on the rivers |
| 14. | Coastal Zone | D | There is no alignment in the coastal area |
| 15. | Flora and Fauna | D | Existing lines are used. There is no valuable flora and fauna. |
| 16. | Meteorology | D | Large scale fills and construction of high buildings are not planned |
| 17. | Landscape | D | No new alignment plan. |
| Pollution | | | |
| 18. | Air Pollution | D | There is no impact on air quality by increasing traffic volume during operation stage |
| 19. | Water Pollution | D | Influence on rivers by discharge water from railway facilities is unknown |
| 20. | Soil Contamination | D | There are no activities causing soil contamination |
| 21. | Noise and Vibration | B | There will be some impact on noise and vibration by increasing the operation speed during the operation stage |
| 22. | Land Subsidence | D | Developed land is used |
| 23. | Offensive Odor | D | There are no factors causing offensive odors |

Note1: Evaluation categories:

A: Serious impact is predicted

B: Some Impact is predicted

C: Extent of impact is unknown (Examination is needed. Impact may become clear as study progresses)

D: No impact is predicted. EIA is not necessary

Note 2: The evaluation should be made with reference to the Explanation of Item.

Table 7.7.10 Matrix for Scoping Classified by Project Phase

| Major facilities, activities Activities which may cause impacts | | Railway Facilities/ Construction of Railway | | | | | |
|---|--------------------------------------|---|---|---|----------------------|-------------------------|--|
| | | Overall Evaluation | Before Operation | | After Operation | | |
| | | | Reclamation and spatial occupancy | Operation of construction equipment | Occupancy of land | Operation of railway | Accumulation of people and goods |
| Environmental Factors | | | | | | | |
| Social Environment | 1. Resettlement | | | | | | |
| | 2. Economic Activities | | | | | | |
| | 3. Traffic and Public Facilities | | | | | | |
| | 4. Split of Communities | | | | | | |
| | 5. Cultural Property | | | | | | |
| | 6. Water Rights and Rights of Common | | | | | | |
| | 7. Public Health Condition | | | | | | |
| | 8. Waste | X | | | X | | |
| | 9. Hazards (Risk) | | | | | | |
| Natural Environment | 10. Topography and Geology | | | | | | |
| | 11. Soil Erosion | | | | | | |
| | 12. Ground Water | | | | | | |
| | 13. Hydrological Situation | | | | | | |
| | 14. Coastal Zone | | | | | | |
| | 15. Flora and Fauna | | | | | | |
| | 16. Meteorology | | | | | | |
| | 17. Landscape | | | | | | |
| Pollution | 18. Air Pollution | | | | | | |
| | 19. Water Pollution | | | | | | |
| | 20. Soil Contamination | | | | | | |
| | 21. Noise and Vibration | X | | | X | | |
| | 22. Land Subsidence | | | | | | |
| | 23. Offensive Odor | | | | | | |

Note: XX: The environmental items to which special attention has to be paid. They might be serious impacts that may affect the project formulation depending on the magnitude of the impacts and the possibility of the measures.

X: The environmental items that may have a significant impact depending on the scale of the project and site condition

No mark: The environmental items requiring no impact assessment since the anticipated impacts are, in general, not significant.

(2) Overall Evaluation of Initial Environmental Examination

The management plan comprises various kinds of institutional programs, improvement plans and a few new developments such as combined transport. In the course of IEE, only a few impacts were identified due to the development a few new facilities. Most of the impacts arising from the plan affect on positive side. It is concluded that EIA is not required for this plan although a few direct impacts, noise and vibration, caused by improvement of railway service such as high speed train operation will be taken into consideration for further detailed examination.

1) Noise and Vibration

a. Noise

Most of the adverse impacts of railways on people could be described as nuisance. Train noise is the most measurable nuisance caused by railways. IEE procedures identified some impacts on noise by the plan, which comprise improvement of operating speed and high speed trains. However as the plans involved existing lines, the impact on noise will be minimal. However some examination of noise and vibration is given as follows:

In comparison with the other transport noise level shown in the following table, railways, e.g. BR electric train, shows that rail's noise level (93-99 dB(A)) remains between aircraft and cars, 110 dB(a) and 80 dB(a) in peak noise level respectively.

Table 7.7.11 Typical Transport Noise Level

| | Peak Noise dB(A) | Maintained Noise Level | Position of observer |
|------------------------|------------------|------------------------|----------------------------|
| Aircraft B747 | 110 | | 250 m below |
| Passenger Car | 80 | | 25 m from train or vehicle |
| Articulated Lorry | 85-90 | | ditto |
| Highway Traffic | | 75-85 | ditto |
| BR Electric (160 km/h) | 93 | | ditto |
| TGV SE (270 km/h) | 99 | | ditto |
| Busy road intersection | | 60 - 70 | on side walk |
| Underground Station | 100 - 105 | | on platform |
| Train Horn | 100 - 110 | | at 30 m |

Source: The environmental impact of railways

The BDZ noise level measured in Sofia residential areas shows rather a higher level of noise compared to reference data shown in Table 7.7.12. In general, train noise can be generated in the following:

- motive power unit: noise from engine and ancillary equipment escaping through exhausts or openings in the casing
- wheels running on rails
- aerodynamic effects
- vibrating structure

In another comparison between measured data of BDZ noise level and other country's railways, even high speed trains and different operating speeds, there seems to be little difference among them. For example BDZ express train shows 98 dB(A) of SEL at 90 km/h while TGV SE shows 93 dB(A) at 200 km/h.

Table 7.7.12 Noise Sampling Level and International Comparison

| | Type | Speed (km/h) | SEL | L _{max} | Remark |
|---------------------------|----------------|--------------|-------------|------------------|---------------------|
| BDZ | Express Train | 90 km/h | 92.7 - 98.3 | 84 - 96.5 | |
| | Fast Train | 90 km/h | 90.1 - 96.1 | 84 - 89 | |
| | Electric Train | 90 km/h | 83.6 - 90 | 70 - 78 | |
| | Freight | 60 km/h | 87.8 - 97.9 | 76 - 84 | |
| BR Coach | Passenger | 144 km/h | 88/90 | 82/85 | Electric |
| ICE | Passenger | 200 km/h | - | 86/82 | Electric |
| High Speed Train (HST125) | Passenger | 200 km/h | 97 | 94 | Diesel |
| TGV SE | Passenger | 200 km/h | 93 | 84 | 600 m long |
| BR Intermodal freight | Freight | 80 km/h | - | 89 | |
| French freight | Freight | 80 km/h | - | 86 | 450 m long/ Lacq 64 |

Note: data shows in dB(A) 25 m from track center. Data of BDZ shows in residential area in Sofia. BG level: daytime; 55.7 dB(A), night; 44.5 dB(A)

Source: JICA Study and The environmental impact of railway

In BDZ's case, the noise generation source can be the motive power unit and wheels running on rails. These stem from issues of railway maintenance that are proposed in the plan. Further improvement will reduce noise level. Consequently impact on noise level will be minimal.

Noise generation on the rails can be reduced by:

- better design of wheels, suspension and brakes to reduce wear,
- regular grinding of rail to remove corrugations
- avoidance of rail discontinuities in sensitive area
- resilient track mountings or fastenings, especially on elevated structure or in tunnels

b. Vibration

Diesel engines generate mainly low frequency sound. This can be radiated to surroundings where it reaches buildings. The main vibrations transmitted to the ground arise from forces between the wheels and the rails. The suspension and bogies of passenger trains, particularly electric multiple units, reduce the vibrations. Heavy freight wagons are more likely cause of vibration.

The impact of vibration is potentially serious for structures (3mm/s; historical building, 10 mm/s; residential, 20 mm/s; commercial buildings) and human comfort (above 3mm/s). Typical acceptability criteria of vibration is 0.3 - 2.0 mm/s (The environmental impact of railway).

Table 7.7.13 Vibration level in Sofia Residential Areas

| Type | Speed (km/h) | Peak particle velocity (mm/s) |
|-----------------|--------------|-------------------------------|
| Express Train | 90 km/h | 0.280 - 0.460 |
| Fast Train | 90 km/h | 0.280 - 0.420 |
| Passenger Train | 90 km/h | 0.500 |
| Electric Train | 90 km/h | 0.230 - 0.400 |
| Freight | 60 km/h | 0.210 - 0.580 |

Source: JICA Study Note: data measured 25 m from track center.

In this regard, measurement results of vibration in Sofia residential areas show peak particle velocity that ranges from 0.21 to 0.58 mm/s shown in Table 7.7.1. Also for noise level results,

there seems to be little differences among train category. It can be seen major results vibrations caused by BDZ train in Sofia residential area is well below the acceptability categorized of 0.3-2.0 mm/sec. given above.

In addition, vibration can be reduced at source by the following:

- improved design of suspension and bogies of rolling stock
- vibration-absorbing resilient track

2) Waste

Solid waste is generated in the operation and maintenance phases. The nature of this waste is mainly divided into two categories waste caused by passenger waste which is removed in major depots and maintenance station and, freight waste leftover in wagon from freight cargoes. Source of this impact is predicted in the operation and maintenance of railways.

7.7.4 Environmental Consideration

The considerations will be made in order to enhance positive impacts and minimize negative impacts figured out by results of environmental analysis based on this management plan and for further programs.

(1) Long Term Environmental Policy for the Railways

In response to the management plan, a concrete longer-term environmental policy should be formulated in order to better maintain a sustainable railway environmental condition.

Short term target plans in consideration of environmental aspects was formulated and is being implemented while the long term environmental plan is needed to confirm with the EU treaty 130r (2) which states "environmental damage should as a priority be rectified at source and that polluter should pay". In this regard, the proposed plans should have the environmental management plan based on BDZ's long-term environmental policy so that purpose of this management plan will be environmentally sustainable.

(2) Railways as an Environmentally Advantaged Transport

It is an attempt to present comparative information about transport energy use and emissions from road and railway transport, the Table 7.7.14 shows an order-of-magnitude that railway contributions are significant apparently.

One of the article of EU transport policy recommends the sue of combined transport to its members mainly because of its environmentally friendly aspects and the BDZ management plan include combined transport in compliance with this EU policy.

Table 7.7.14 Typical Transport Energy Use and Emissions

| Transport type | Energy Use (KJ/Passenger-km) | CO ₂ | Nox | SO ₂ | CO | HC | VOC |
|-------------------------|---------------------------------|-----------------|-----|-----------------|------|-------|-------|
| Road Passenger | | | | | | | |
| Cars | 2,000 | 150 | 2 | 0.05 | 10 | 1.5 | 2 |
| Buses | 800 | 40 | 1.0 | 0.1 | 0.5 | 0.1 | 0.5 |
| Rail Passenger | | | | | | | |
| All train | 800 | 80 | 0.6 | 0.3 | 0.2 | 0.2 | 0.3 |
| Diesel train | 800 | 80 | 1.5 | 0.2 | 0.2 | 0.1 | 0.5 |
| Electric train | 800 | 80 | 0.5 | 1.0 | 0.02 | 0.001 | 0.001 |
| Road freight | | | | | | | |
| | (KJ/ton-km) | | | (g/ton-km) | | | |
| All road | 2,000 | 250 | 4 | 0.3 | 2 | 0.5 | 1.0 |
| Large lorries | 1,000 | 100 | 3 | 0.2 | 0.2 | 0.3 | - |
| All Rail freight | | | | | | | |
| Diesel | 700 | 40 | 0.3 | 0.3 | 0.2 | 0.05 | 0.1 |
| Diesel | - | 40 | 0.7 | 0.1 | 0.15 | 0.1 | 0.1 |
| Electric | - | 40 | 0.2 | 1.0 | 0.01 | | 0.01 |

Source: The environmental impact of railways, Note: KJ; kilo-joules (1J=10⁷erg=0.239 Cal.)

(3) Facilities Development and High Speed Trains

It is recommended that further detail environmental analysis of each compartment plan, particularly high speed train and related facilities development shall be conducted when the feasibility study is implemented.

(4) Planning Standard

Standards should be set for either noise generation or noise reception levels in order to conserve human health and a comfortable living environment. There is no standard related to the noise and vibration emitted by railways in Bulgaria. Maximum train noise (L_{max}) generated at source is subject to upper limits. Examples of source standards are illustrated as follows:

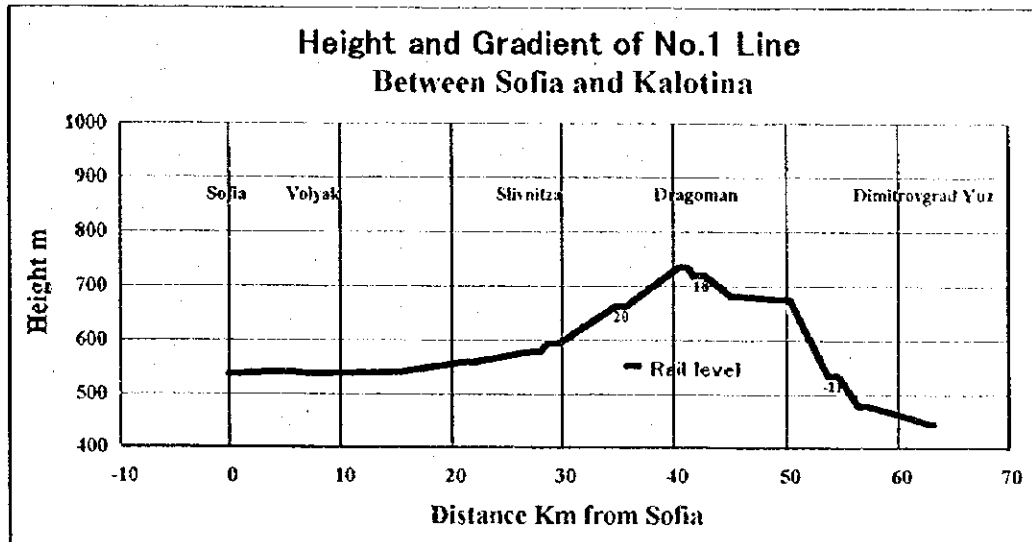
- 90 dB(A) for US diesel Locomotive built after 1979
- 85dB(A) for Danish rolling stock wheel noise
- 96 dB(A) in the specification for Eurostar at 300 km/h

Noise reception standards shall be formulated to define the level of acceptability. Typical standards for 24 hours L_{aeq} at house facade are as follows:

- 70 dB(A) for new railway in Japan
- 69 dB(A) for SNCF TGV, reduced to 64 dB(A) in the latest guideline for application in residential areas
- 65 dB(A) for London Docklands Light Railway's Becton extension (bill)

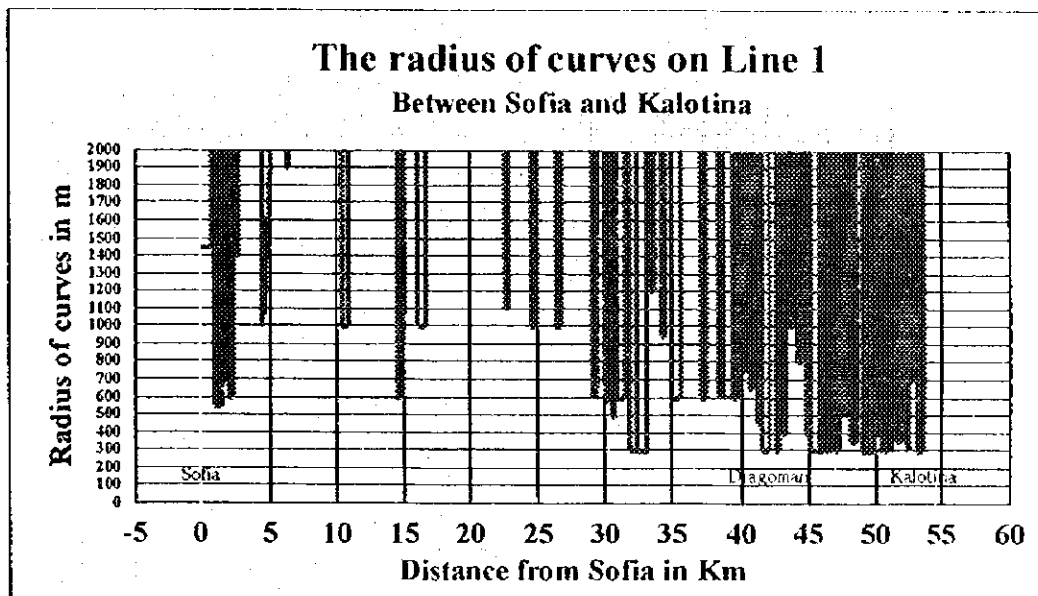
3. APPENDIX FOR TRAIN OPERATION PLAN OF CHAPTER 8.2

APPENDIX FOR THE ITEM 8.2.1

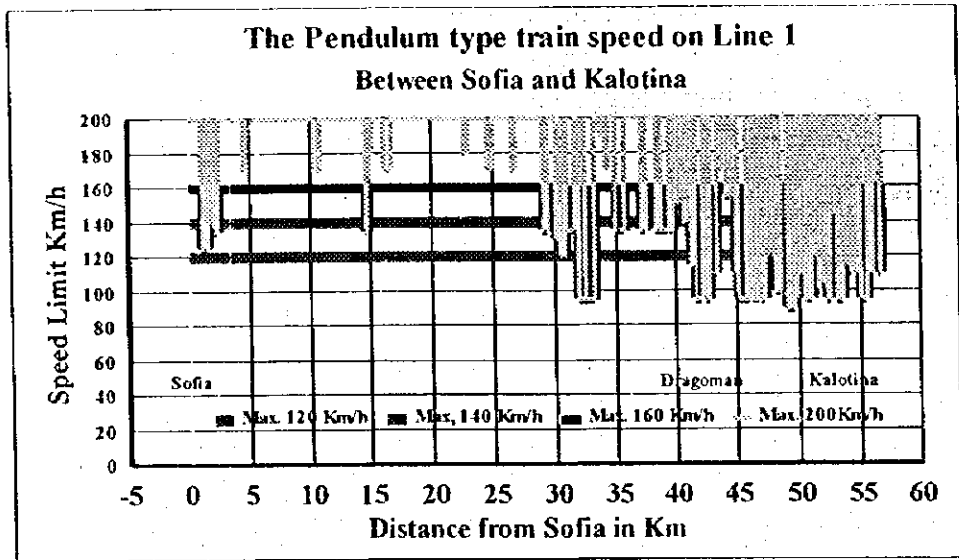
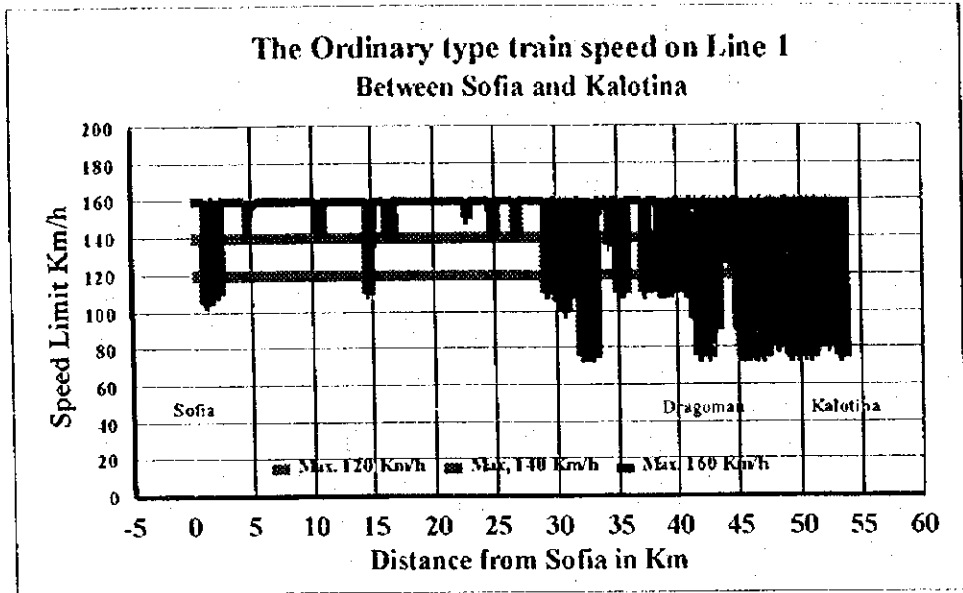


A-1 Figure of the track gradient between Sofia and Kalotina

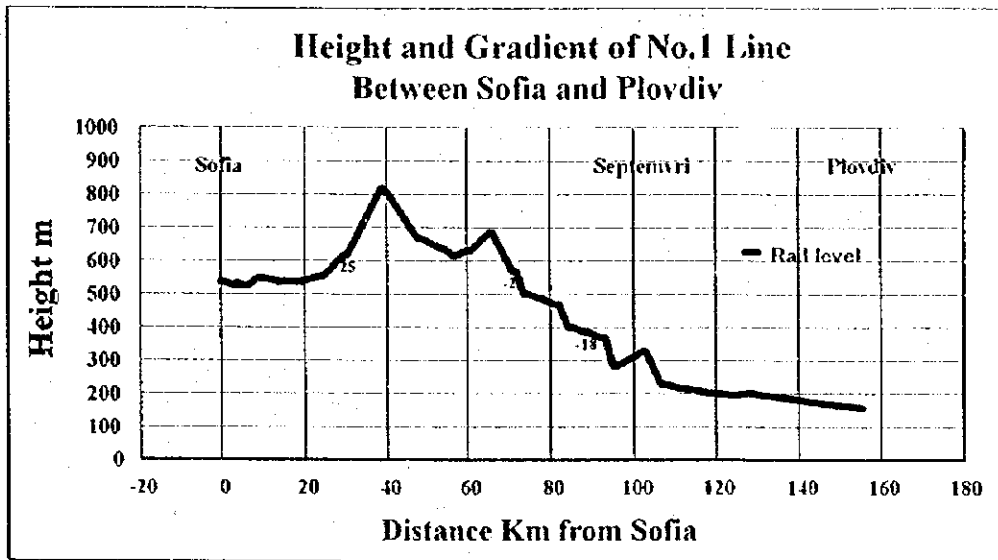
The highest track level is about 740 m at Dragoman station. The gradient is maintaining down to Sofia and to Dimitrovgrad Yuz



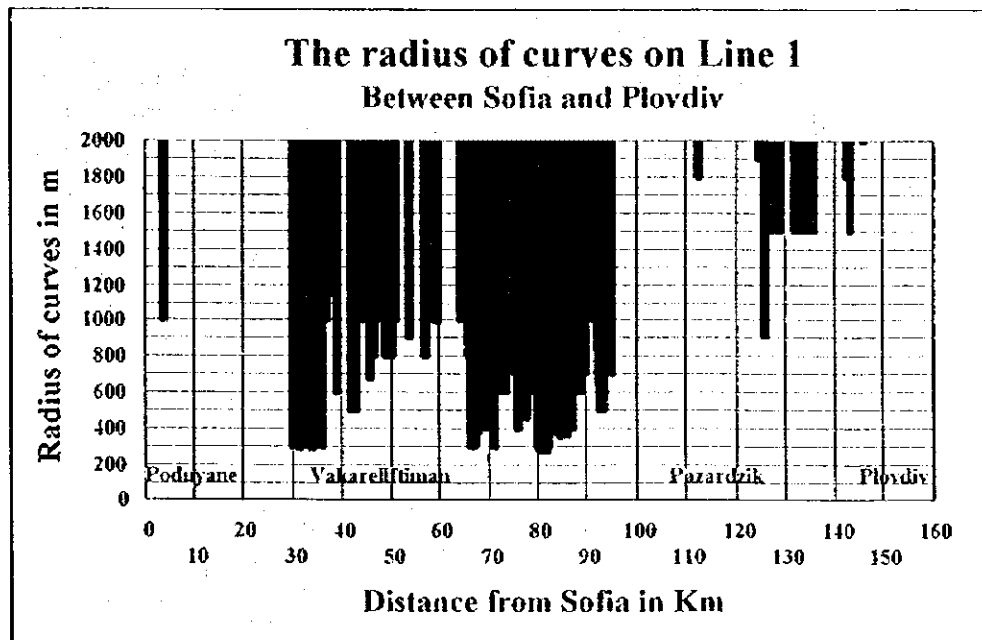
A-2 Curves between Sofia and Kalotina



A-3 Curves and speed limit of ordinary and pendulum type train between Sofia and Kalotina

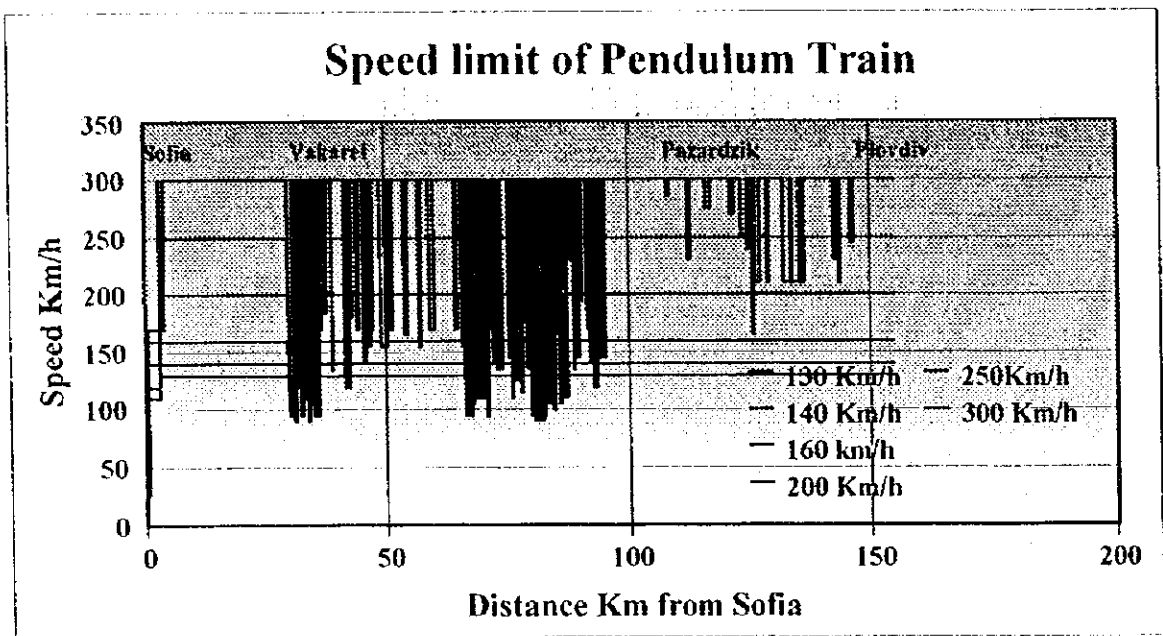
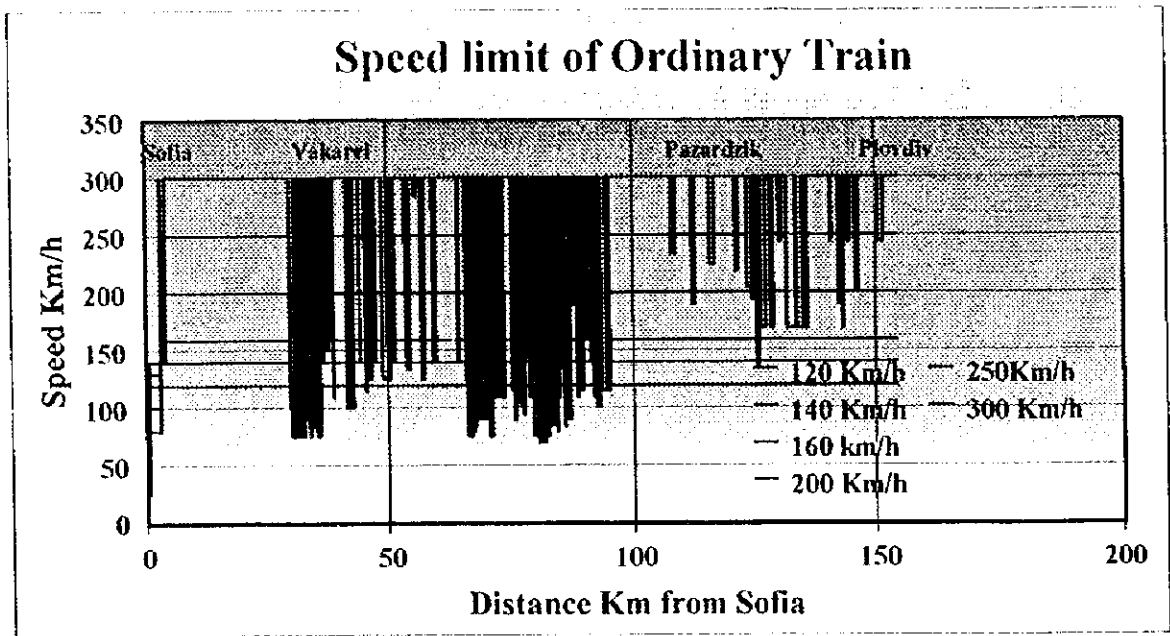


A-4 Figure of the track gradient between Sofia and Plovdiv



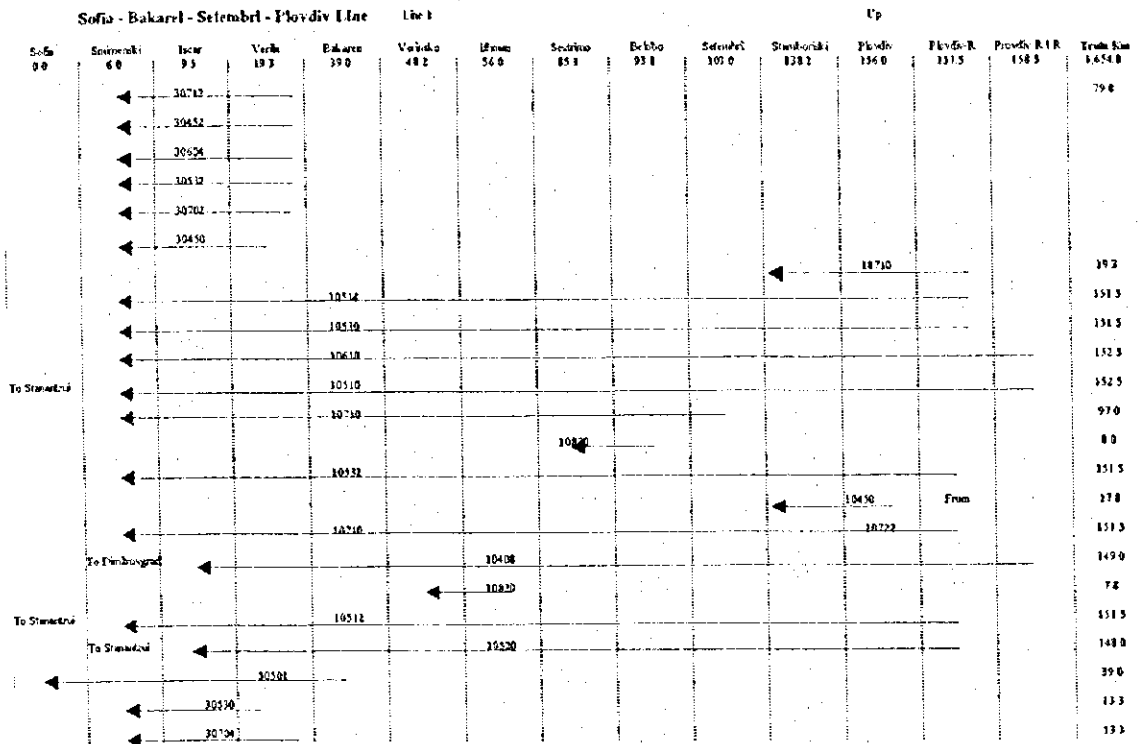
A-5 Curves between Sofia and Plovdiv

The sections of tight curves are admitted between 29 km and 95 km. The sections of 29-37 km and of 65-88 km are restricted by smallest curves of 300 m.

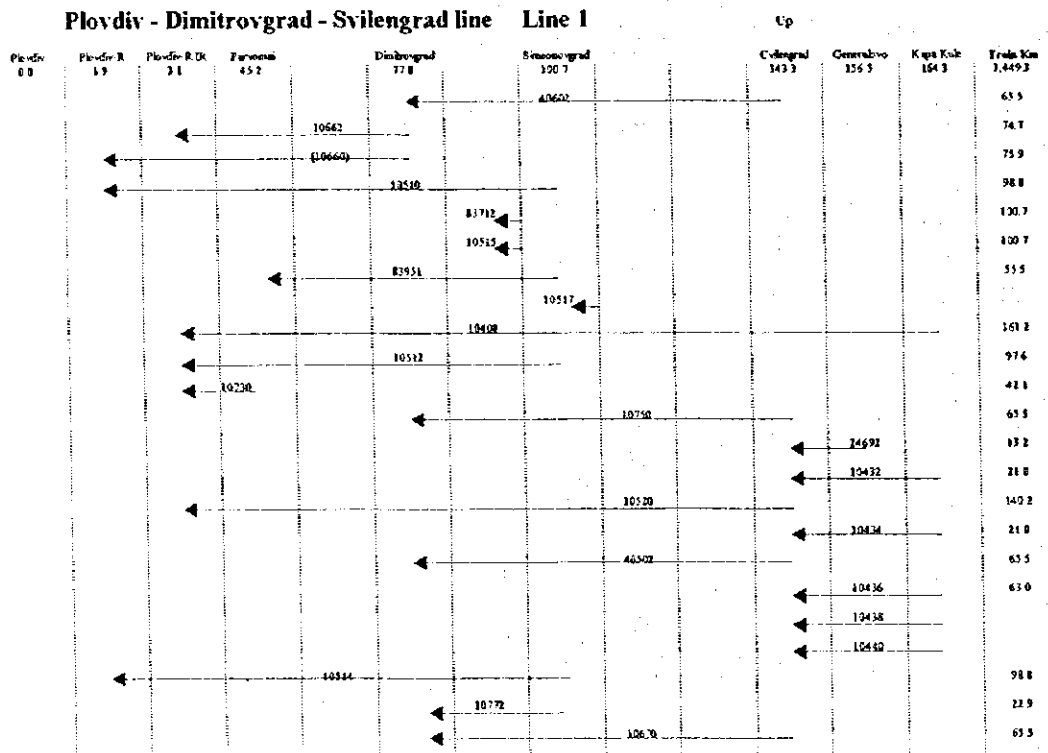


**A-6 Curves and speed limit of ordinary and pendulum train
between Sofia and Plovdiv**

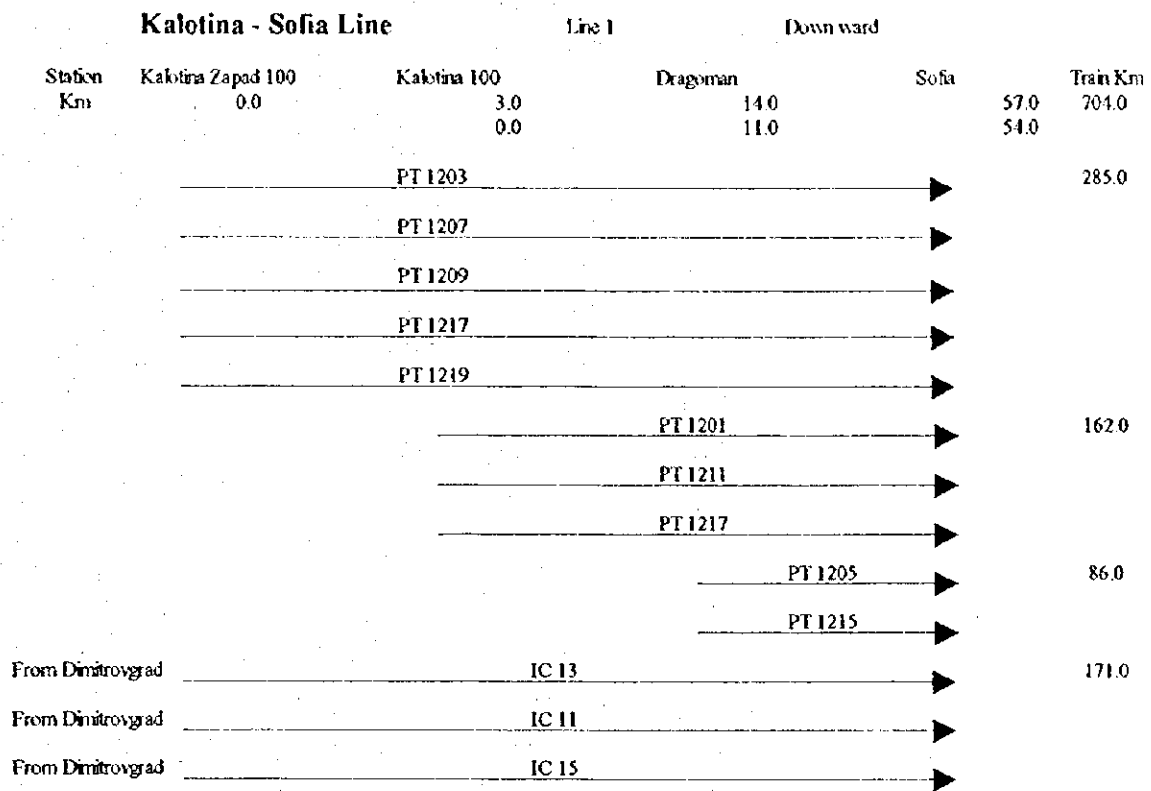
The track section between Sofia and Plovdiv is abundant of up and down gradient because of the existence of mountain range.



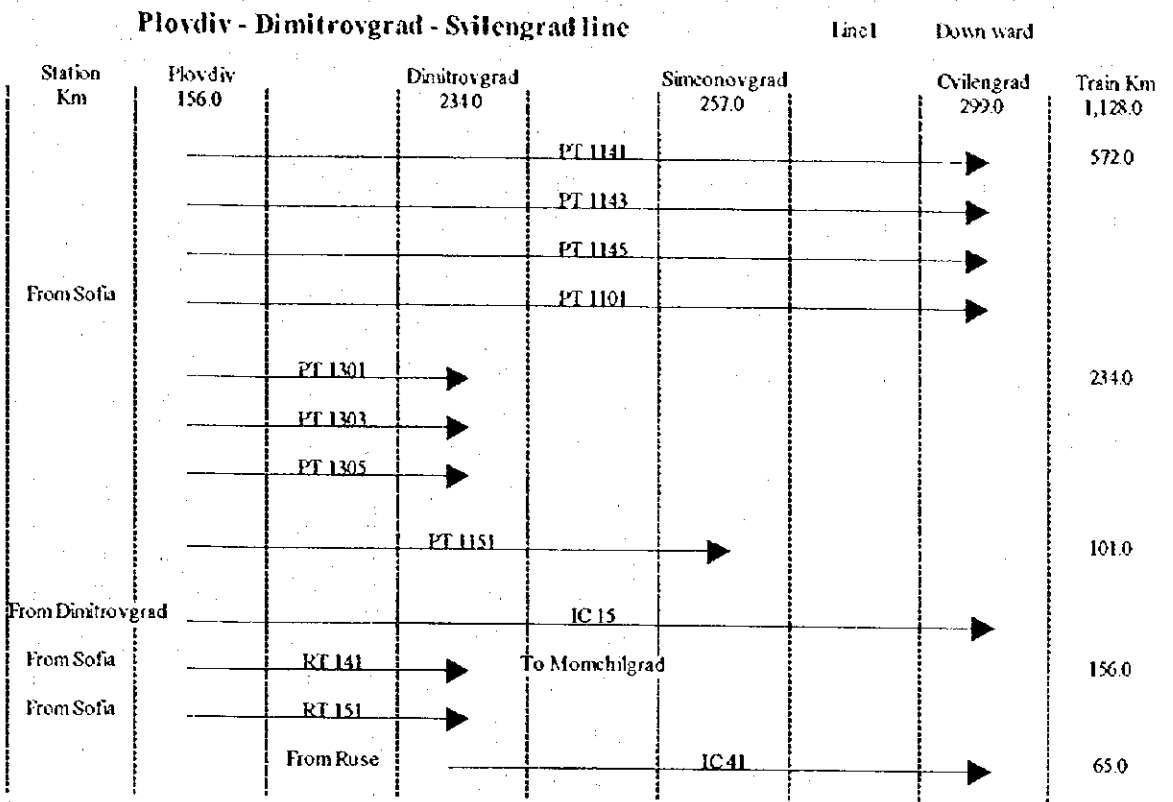
B-2: Bar Chart of Freight Train of Sofia – Plovdiv



B-3: Bar Chart of Freight Train of Plovdiv – Svilengrad

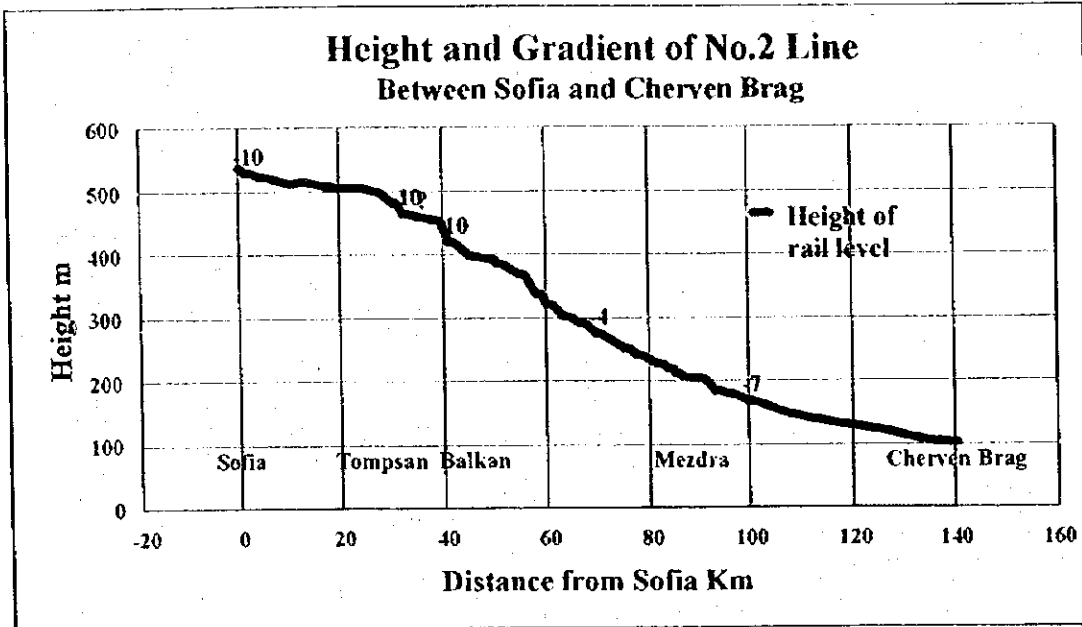


C-1: Bar Chart of Passenger Trains between Sofia and Kalotina

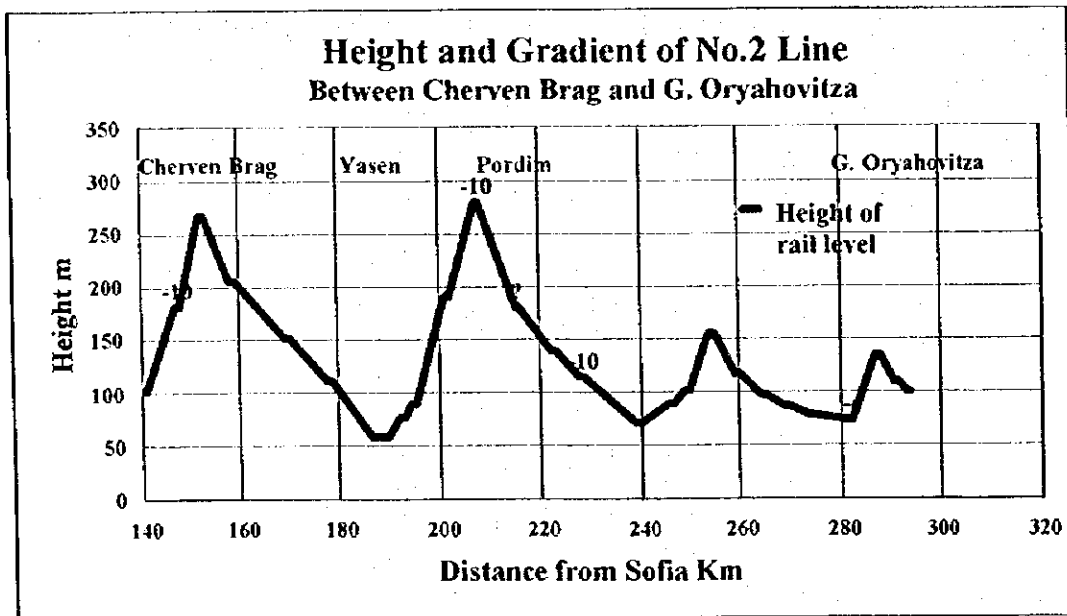


C-3: Bar Chart of Passenger Train between Plovdiv and Svilengrad

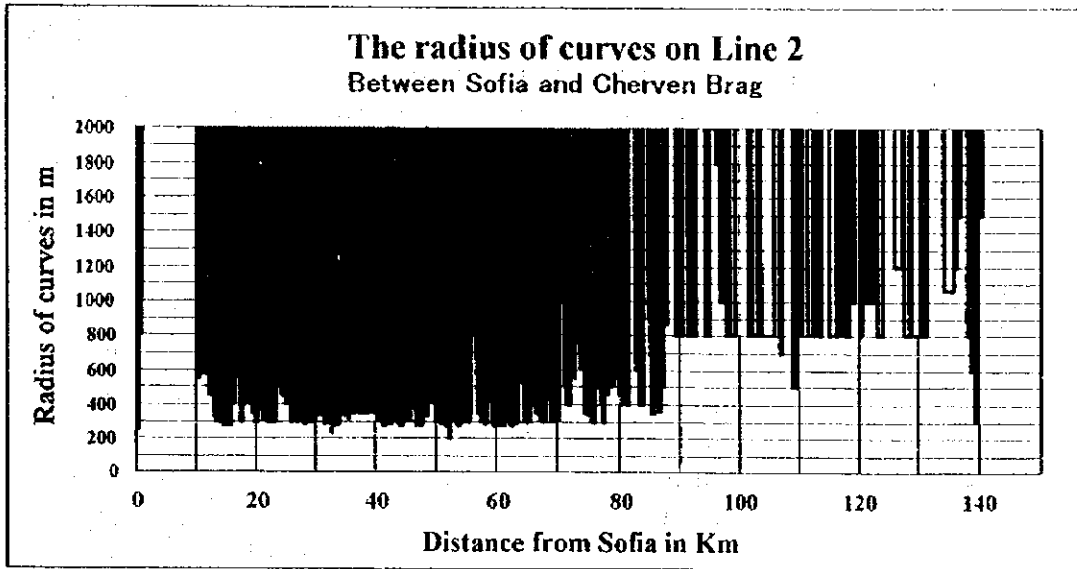
APPENDIX FOR THE ITEM 8.2.2



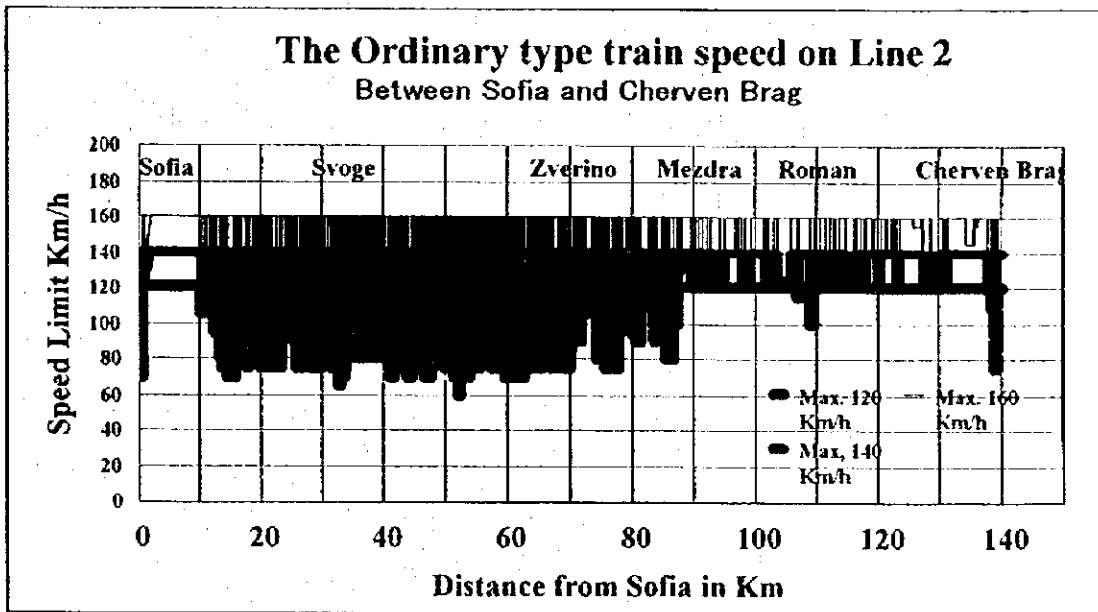
D-1: Figure of track gradient between Sofia and Cherven Brag



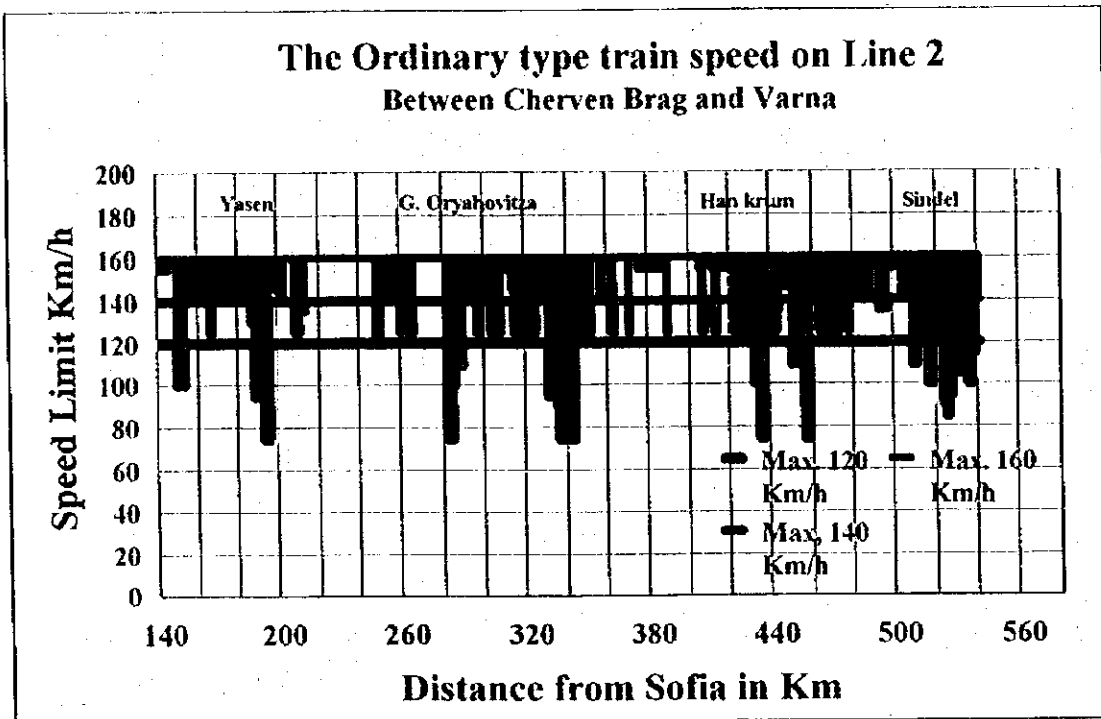
D-2: Figure of track gradient between Cherven Brag and G. Oryahovitza



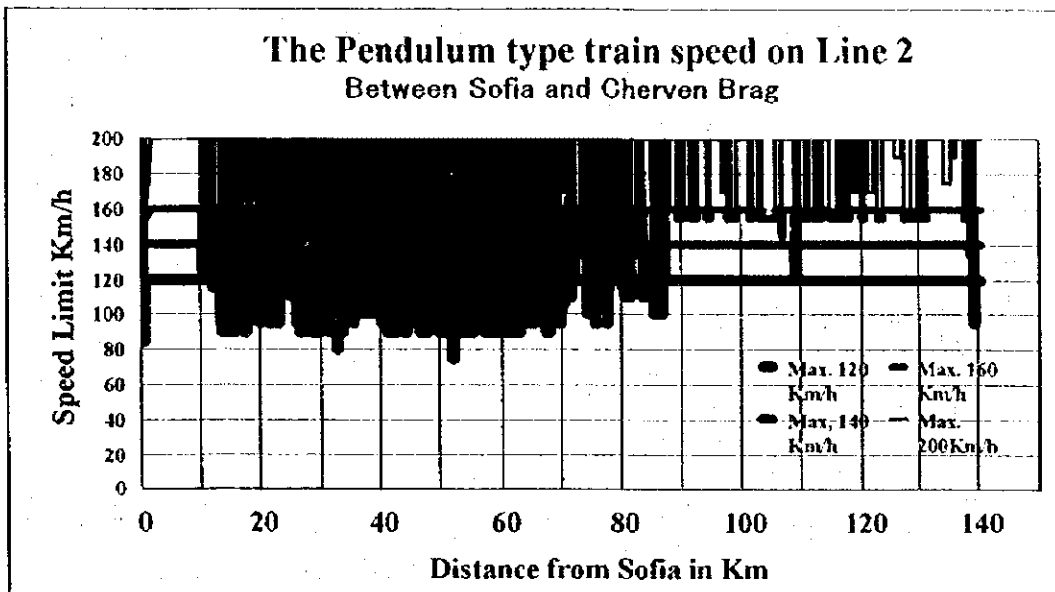
D-3: Curves between Sofia and Cherven Brag



**D-4: Speed limit in case of ordinary type train
between Sofia and Cherven Brag**

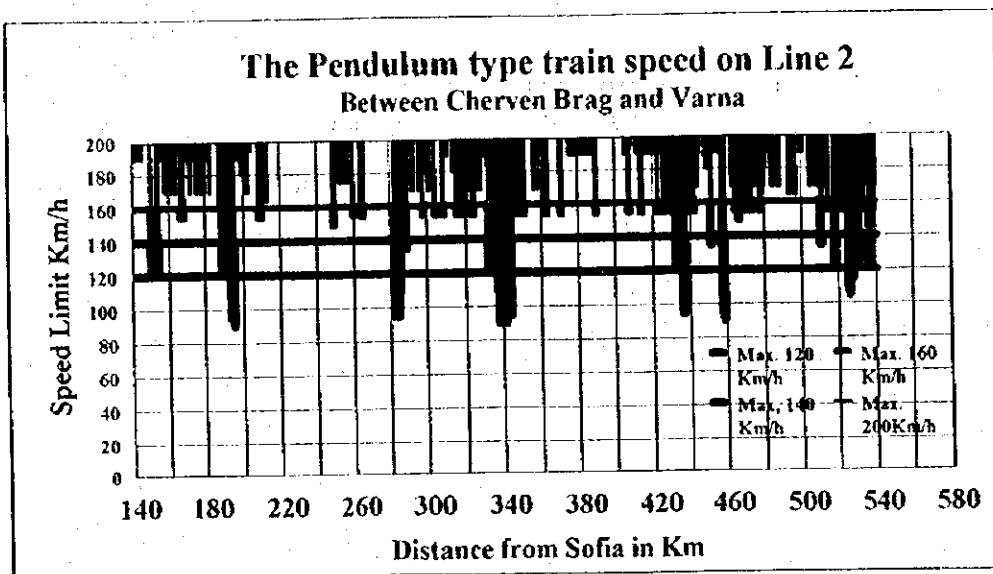


D-5: Speed limit in case of Ordinary type train
between Cherven Brag and Varna



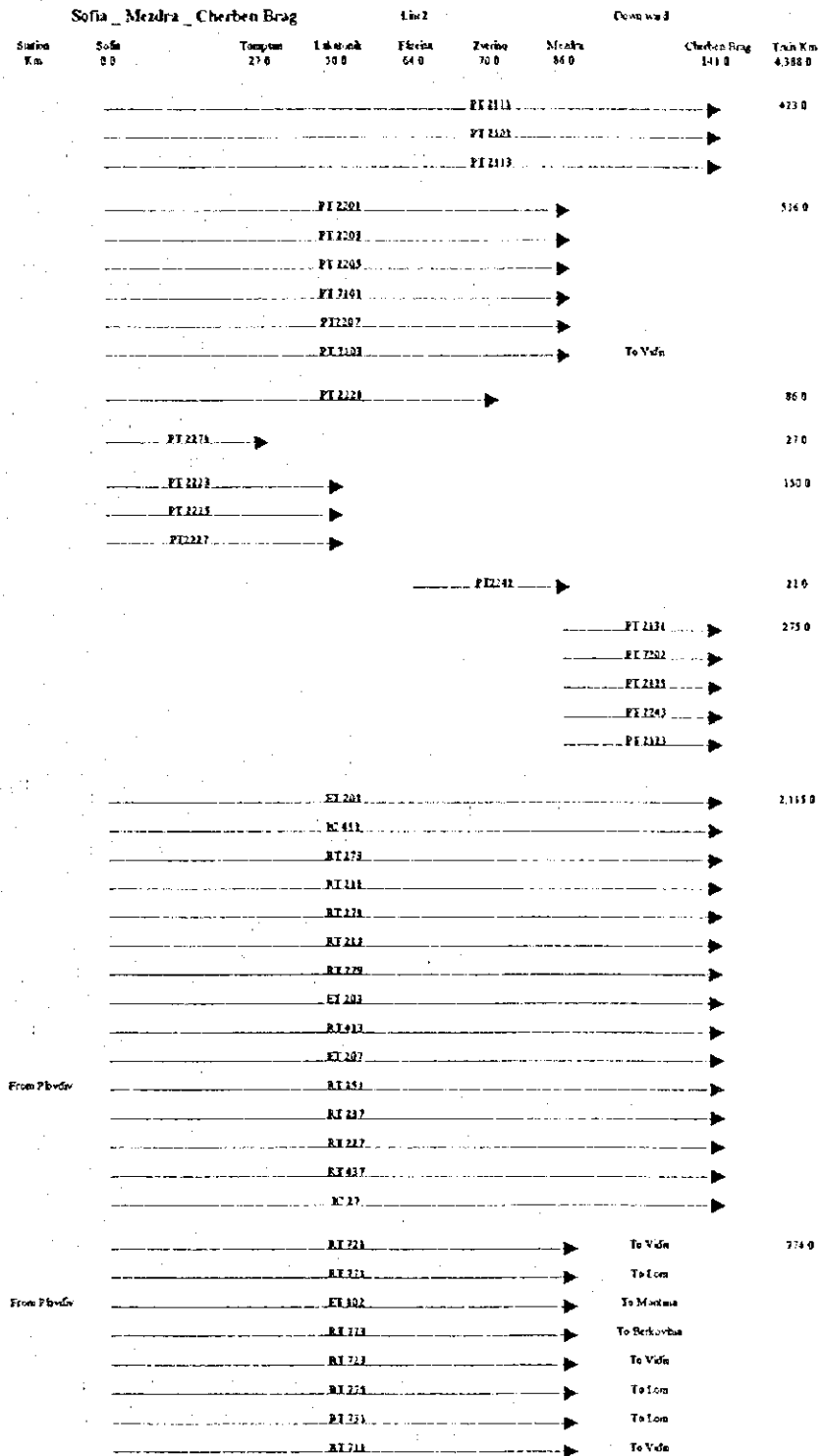
**D-6: Speed limit in case of pendulum type train
between Sofia and Cherven Brag**

The speed limitation at major stations are giving fatal influence for increasing speed. By special project which will solve the limitation, big effect will be brought out for BDZ. The track figures of intermediate way between Cherven Brag and Varna can be used effectively for the future high speed operation.

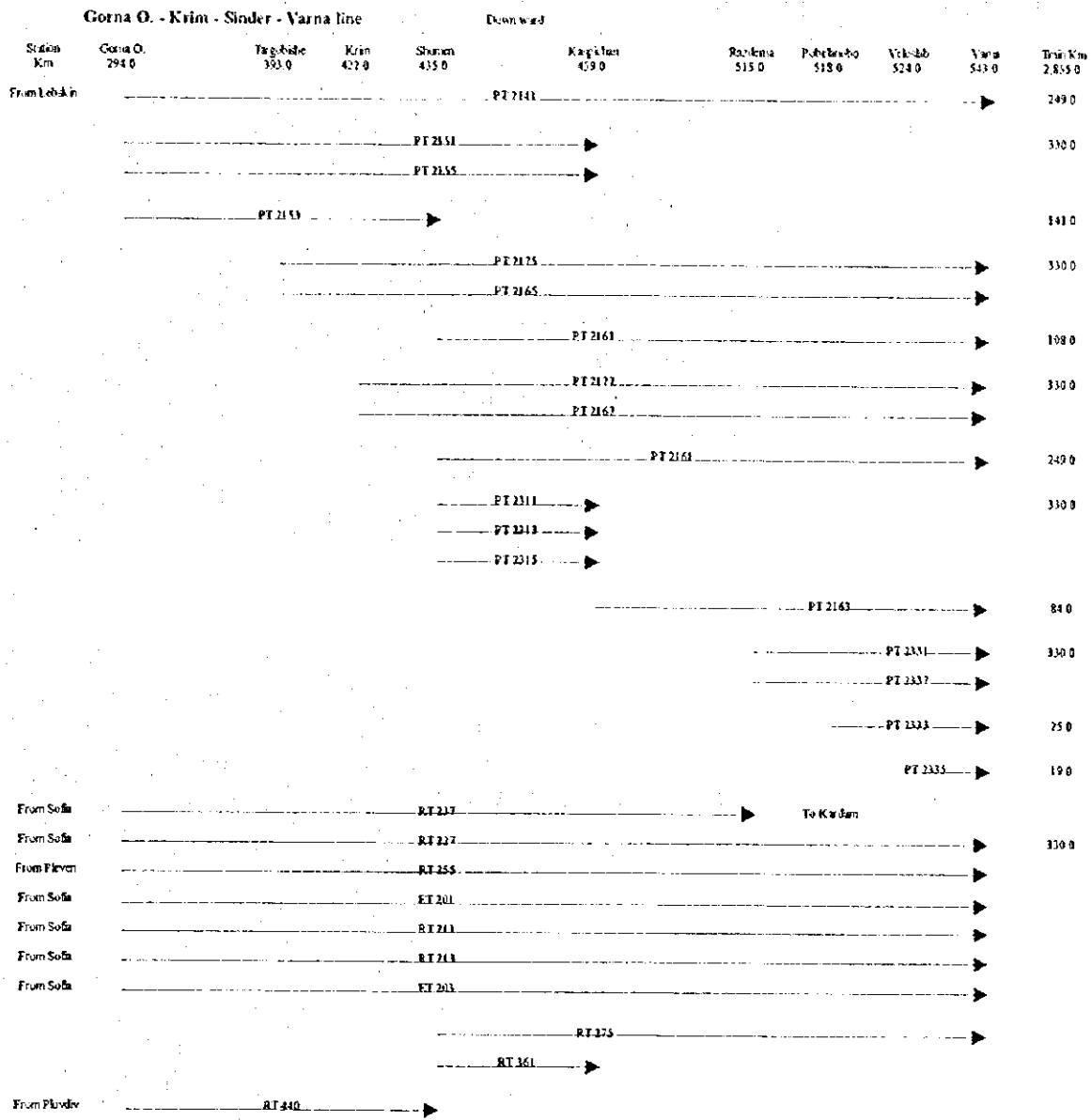


**D-7: Speed limit of pendulum type train
between Cherven Brag and Varna**

The 160 km/h pendulum train with light weight construction can run at maximum speed by improving the speed limit at the entrance and out going places of major stations. The capability of track figure of the BDZ will contribute to the future social activity of Bulgaria. The economical effect of speed up can be assumed through the example analysis which are done on the track between Sofia and Plovdiv.

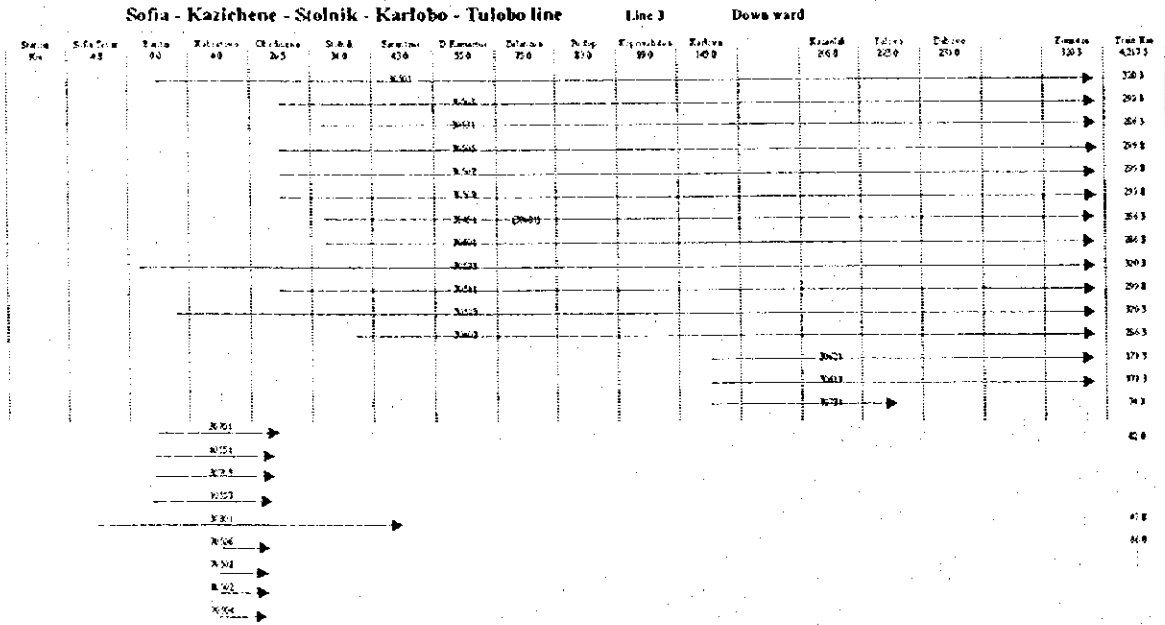


E-3: Bar chart of Passenger trains of Sofia – Cherven Brag of No.2 line

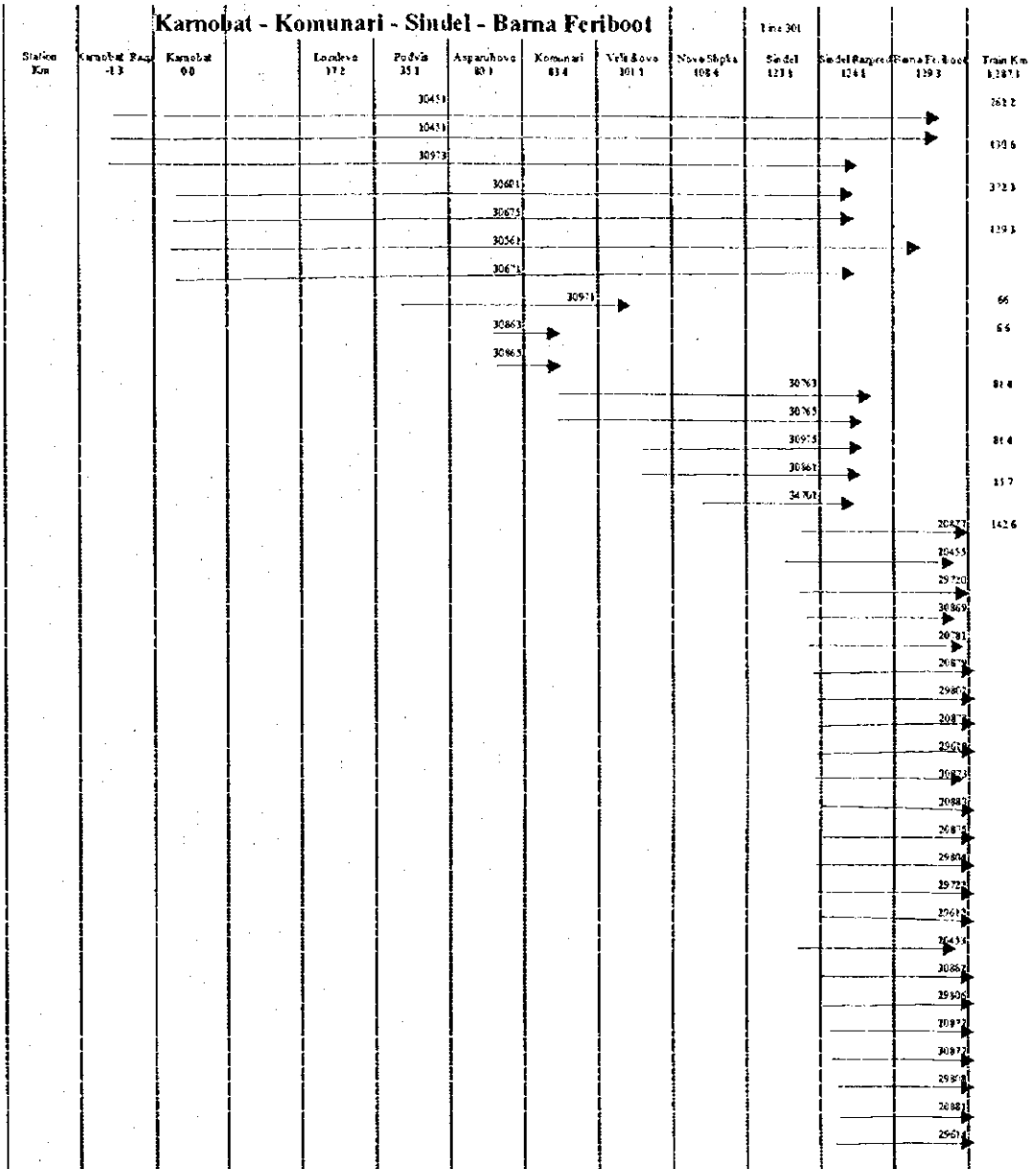


E-5: Bar chart of Passenger trains of G. Oryahovitz – Varna of No.2 line

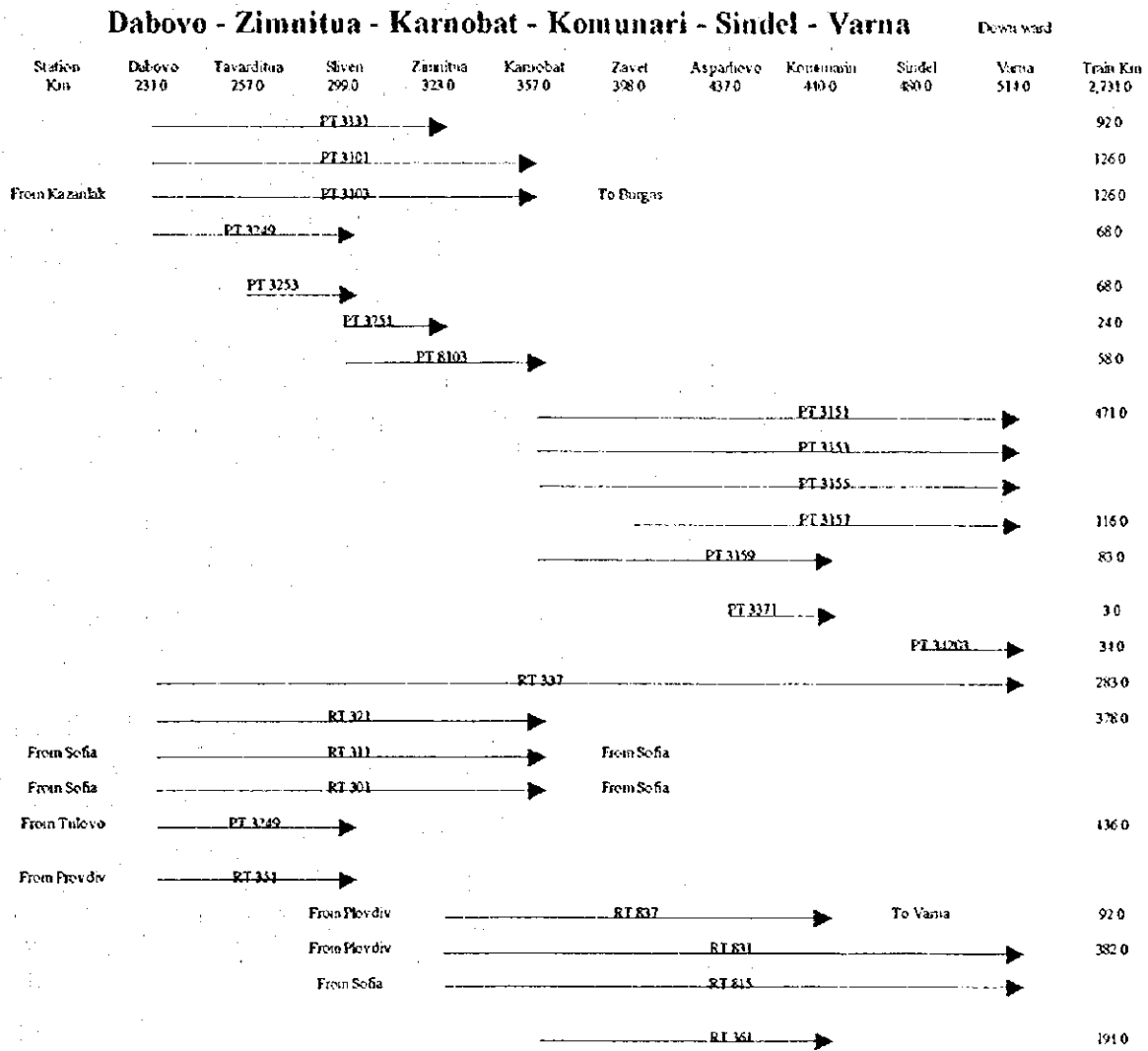
APPENDIX FOR ITEM 8.2.3



F-1: Bar Chart of Freight Train of No. 3 line between Sofia and Dabovo of No.2 line



F-2: Bar Chart of Freight Train of No.3 line between Dabovo and Varna of No.2 line



F-4: Bar chart of Passenger trains of Dabovo – Varna of No.2 line

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